

The British Computer Society

Professional Examination

Your Guide to Study



THE BRITISH COMPUTER SOCIETY

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- General enquiries
- Membership queries
- Fee details
- Study guides and other materials
- Entry requirements and procedures
- Examination venues
- Courses and course providers
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Sections

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Section 1

A standard for today and the future

INTRODUCTION

Qualifications to match your ambition

- 1 Do you want greater recognition of your expertise?
- 2 Are you planning to advance your career and achieve promotion?
- 3 Are you considering an entirely new career direction in Information Technology?
- 4 Do you want the satisfaction of achieving a valuable professional qualification?

Whatever you want to achieve in your career, the BCS Professional Examination can help fulfil your ambition. The British Computer Society (BCS) Professional Examination is an internationally recognised qualification, essential for a career in computing and Information Technology. It is examined to the level of a UK honours degree and acknowledges your practical experience as well as your academic abilities. It will give you a distinctive edge over the competition, as employers can be confident that you know not only what you are doing, but how and why.

Parallel Systems, Management Information Systems and Programming Paradigms.

2. Notice of discontinuation given: of Software Development Environments and Safety Critical and Real Time Systems modules.

Notice of discontinuation given: of current syllabus after April 2005 sitting for Professional Issues in Information Systems Practice and for Object Oriented Programming. See updated (Version 2) syllabuses.

CHANGES TO STUDY GUIDE – 2003/4 EXAMINATION

This Study Guide and the material within it is valid for the October 2003 and April 2004 Examinations.

Changes since the last edition are as follows:

1. New: Object Oriented Programming (new syllabus for October 2003), Professional Issues in Information Systems Practice (new syllabus for April 2004). Brand new Fundamentals of Software Engineering module for April 2004 (syllabus to be published separately in September 2003).
Minor changes: (less than 10%) to the following syllabuses: Software Development, Technology, Project Management, Systems Analysis, Computer Services Management, Distributed &

3. Expansion: of October 2003 sitting to include 5 Diploma modules: Professional Issues in Information Systems Practice, Computer Networks, Database Systems, Object Oriented Programming (new syllabus only), Systems Analysis.

SUPPORTING THE IT COMMUNITY

The British Computer Society is the Chartered Engineering Institution for the IT profession. We set and maintain the highest standards of professionalism and assist individuals to improve their skills throughout their careers. As the only Chartered Professional Institution specialising in Information Technology, we play a leading role in tackling legal, technological, commercial and sociological issues relating to IS, as they emerge.

THE ESSENTIAL QUALIFICATION FOR ALL BUSINESSES

No organisation, large or small, can function effectively without its computers or its Information Technology. It is therefore essential that all IT employees are competent and have the appropriate professional qualifications. The BCS Professional Examination confirms your proficiency, and endorses your skills and capabilities. It aims to give you a substantial breadth and depth of knowledge and the ability to apply that knowledge in your workplace.

PATHWAY TO PROFESSIONAL MEMBERSHIP

Professional Members of the BCS can show that they are experienced and qualified, with the high level of competence and integrity required in the field of Information Technology today.

As the IT industry develops, career progression will depend heavily on the attainment of a recognised professional qualification.

Professional Membership starts at the AMBCS (Associate Member) grade. Graduate Members, from a BCS accredited course, can progress to AMBCS with as little as two years' experience, starting the path of professional development. However, for Graduate Members following the BCS Continuing Professional Development Scheme (CPD) this requirement may be reduced by a year. For graduates completing a non-BCS accredited course, in a relevant subject, the requirement to progress to AMBCS is four years. However, for Graduate Members following the BCS CPD Scheme this requirement may be reduced by a year.

MEMBERSHIP BENEFITS

- **RECOGNITION**
BCS Membership is an industry benchmark. It denotes excellence and integrity and leads to enhanced career prospects. Membership grades begin with Student and Graduate, then move to Professional grades with Associate, Member and Fellow
- **NETWORKING**
Peer-to-peer networking is an important activity for all IT practitioners, face-to-face as well as online. The BCS facilitates access to a wealth of information, experience and expertise.

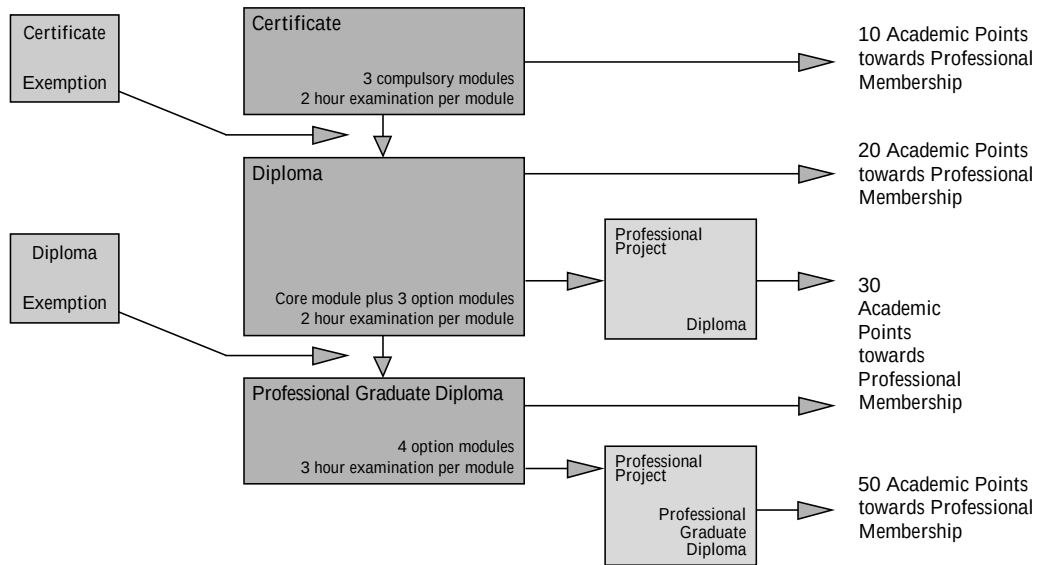
Our national network of over 40 branches and more than 50 specialist groups enables members to exchange ideas and keep abreast of latest developments

- **FREE LIFE TIME EMAIL ADDRESS**
BCS members enjoy a free lifetime email forwarding facility (name@bcs.org.uk). Any mail sent to this address will be forwarded to an Internet account of your choice. This allows you to maintain consistent contact details throughout the course of your career
- **FREE MEMBERSHIP PUBLICATIONS AND DISCOUNTS ON LEADING INDUSTRY BOOKS**
 - *Computing, the leading weekly industry magazine*
 - *BCS Computer Bulletin, our bimonthly membership magazine*
 - *e-bulletin, our bimonthly electronic newsletter*
 - *Computer Weekly (subject to availability)*

BCS titles are available at discounts of up to 25% from key publishers including Pearson Education, Springer-Verlag and Addison Wesley Longman

- **ONLINE DISCOUNTS & BENEFITS**
Online access to preferential rates on financial and insurance products, including professional indemnity, car, home and personal insurance, a mortgage broking service, savings, financial planning, discounted travel and computer equipment
- **ADVICE**
The BCS Professional Advice Service provides online access to a register of approved practitioners with relevant expertise
- **THE BCS LIBRARY**
Online access to a huge range of computer science related titles and information services
- **ACM DIGITAL LIBRARY**
Discounted rates on publications from the last 15 years, plus more than 250,000 pages of text
- **CSS ONLINE**
Discounts on an online directory holding details of 14,000 software products and 8,000 IT service providers in the UK





THE STRUCTURE OF THE EXAMINATION

The Examination has a modular structure, set in three parts.

CERTIFICATE

The Certificate is examined to the academic level of the first year of a Higher National Diploma. It consists of a two-hour written paper on each of the three compulsory modules:

- Information Systems
- Software Development
- Technology

DIPLOMA

The Diploma is examined to the academic level of a Higher National Diploma. It consists of a two-hour written paper on the compulsory core module:

- Professional Issues in Information Systems Practice

PLUS a two-hour written paper on each of three modules chosen from the following list.

- Architecture
- Computer Networks
- Database Systems
- Object Oriented Programming
- Project Management
- Service Management
- Software Development Environments (to be discontinued after April 2005)
- Systems Analysis
- Systems Design
- The Internet and World Wide Web
- New Fundamentals of Software Engineering module (This syllabus will be published separately)

You may attempt either the Professional Project (Diploma level) or go on to the Professional Graduate Diploma

PROFESSIONAL GRADUATE DIPLOMA

The Professional Graduate Diploma is examined to the academic level of a UK university honours degree. It consists of a three-hour written paper on each of four modules chosen from the following list. Alternatively, you can take the Professional Graduate Diploma by submission of a dissertation.

- Advanced Database Management Systems
- Computer Services Management
- Distributed and Parallel Systems
- Knowledge based Systems
- Management Information Systems
- Network Information Systems
- Programming Paradigms
- Safety Critical and Real time Software (to be discontinued after April 2005)
- Software Engineering
- Systems Design Methods
- User Interface Design
- World Wide Web – beyond the Basics

Professional Project (Professional Graduate Diploma level)

HOW TO ENTER

You are strongly urged to read the Regulations and Notes for Guidance section, and to take account of any prior knowledge expected in the syllabus. There are no formal entry requirements for the Examination and you are expected to determine your own suitability for each module you want to enter. See section on Eligibility in the Notes for Guidance. A course of instruction is not mandatory, although we recommend you do not undertake these examinations without adequate preparation.

See the recommended study hours in the Notes for Guidance. We keep a separate list of current courses and indicate which are BCS recognised.

There is no requirement to register with the BCS prior to entry for the Examination and both members and non-members of the BCS may enter for any part of the Examination. Modules and the Professional Project may be taken in any sequence and there is no limit to the number of attempts you can make at written examinations or Professional Project submissions.

There are two sittings of the BCS Professional Examination each year. However, only the Certificate and popular Diploma modules will be offered for the October sitting. The timetable is published during the preceding July. Entry forms for written examinations and Professional Project reports must be submitted by the following closing dates:

OCTOBER SITTING

15 August (all candidates)

APRIL SITTING

6 January (international candidates)

15 January (UK/Ireland candidates)

PROFESSIONAL PROJECT REPORTS

31 January

Entry forms are available from Customer Support and our website www.bcs.org/exam

Professional Projects may be submitted before, during, or after attempting the written examinations. Only one Professional Project submission is allowed in any one year. Please do not submit before 1st December.

Professional Graduate Diplomas by dissertation may be submitted at any time throughout the year.

EXAMINATION VENUES

The BCS has consolidated the number of venues offered in the UK and Ireland and the new venues list is shown below. Please note that this applies to the BCS Professional Examination with effect from the October 2003 sitting.

Standard Examination Venues – UK/Ireland (by city)

Bristol

Dublin

Edinburgh

London

Manchester

For the BCS Professional Examination, no venues will be considered outside those above listed in the UK/Ireland.

Overseas Examination Venues

Note that there is a new policy for setting up venues overseas.

To improve the options to candidates, the BCS has reviewed its procedures for setting up non-standard examination venues. This applies to applicants who live outside the UK only.

If candidates wish to sit the examination at a place not on the standard list, they are asked to state their preference as a first choice on the entry form. The second choice must be from the standard venue list below.

The BCS will consider all preferred first choices and will establish non-standard venues if there are sufficient candidates to make the venue viable. Otherwise an examination venue will be allocated from the standard list, based on second choices.

Non-Standard Venue Entry Closing Dates

- By 21st July for the October sitting
- By 21st December for the April sitting

We regret no entries for non-standard venues can be accepted for either of these sittings after the appropriate dates.

Standard Examination Venues – International (by country)

Bahrain

Cameroon

China (Hong Kong)

Dubai

Greece (Athens)

India (Any British Council Office)

Kenya (Nairobi)

Malaysia (Kuala Lumpur)

Mauritius (Reduit)

Pakistan (Any British Council Office)

Saudi Arabia (Riyadh)

Singapore

Sri Lanka (Colombo)



Examination Results

April sitting

Examination results will be despatched by mail no later than 7th August.

October sitting

Examination results will be despatched by mail no later than 7th February.

Re-sitting Written Papers

Candidates awaiting results from a sitting who will wish to resit any papers that they may have failed, at the next available sitting, will be allowed to do so provided they submit the resit entry form and fee by the later entry closing date, as detailed in the guidance notes which will accompany their result letter. However, this only applies to the papers which are examined twice per year. For entry for all other papers, candidates must submit a proper entry form by the appropriate published closing date.

AWARDS

Awards will be made to both members and non-members of the BCS.

Certificates, Diplomas and Professional Graduate Diplomas will only be awarded if you have passed (rather than been exempted from) at least half of the required number of modules. A transcript will be issued in all cases.

Diplomas will only be awarded to candidates who have passed, or been exempted from, the Certificate.

Professional Graduate Diplomas will only be awarded to candidates who have passed, or been exempted from, the Certificate and the Diploma.

In addition to the Certificate, Diploma and Professional Graduate Diploma, certificates will be awarded for passing individual modules, but only on request.

THE SYLLABUS

The syllabus is kept under review to ensure that it remains current and relevant to the needs of Information Technology Professionals. New optional modules may be added and updates made to existing modules each year. Two years' notice will be given of changes to the structure of the Examination and discontinuation of modules.

EXEMPTION GUIDELINES

Accreditation of Prior Learning (APL)

The APL Scheme offers candidates recognition for appropriate vocational or professional qualifications that they hold. The BCS maintains a list of the qualifications which have been approved under the APL Scheme. Success at any of the qualifications on this list may enable candidates to gain entry at a higher point in the BCS Professional Examination. Credit can be given for an individual module(s) at Certificate and/or Diploma level or for a complete stage. The list of qualifications forms part of the Examination Pack or is available at www.bcs.org/exam/exempt

If you have successfully completed any of the qualifications and wish to apply for credit under our APL scheme, you must complete the Application for Exemption form accompanied by certified copies of certificates and transcripts proving your success at the appropriate qualifications. No fee is required for this.

The Education Department will confirm the credit (exemption) given to you by letter and will notify the Exams Office. Once you have enrolled for the examination(s) your credit will be entered against your examination record and appear on any subsequent result transcript which will be issued to you once you have attempted the BCS Professional Examination.

You may not enter for any BCS Professional Examination module(s) from which you are currently seeking credit under our APL scheme.

If you have a professional qualification that is not included on our APL list but you believe merits exemption from a part(s) of the BCS Professional Examination, you should follow the procedure given under Individual Exemptions below. A fee is payable for assessment of your qualification.

Individual Exemptions

The BCS exempts many UK academic courses at or above HND level from all or parts of the BCS Professional Examination. Please contact Customer Support to see if the BCS has granted exemption to the academic qualification you hold. If not, and you believe that your academic qualification merits exemption from part(s) of the Examination, OR you have an appropriate professional qualification which is not on the APL list which you feel should entitle you to some exemption, you may apply to the Education Department for Individual Exemption.

You can apply for exemption from single modules or from whole levels, e.g. the Certificate. You are expected to determine which modules or parts of the Examination you think your qualification should exempt you from.

You may not enter for any BCS Professional Examination module(s) from which you are currently seeking exemption. However, if exemption is not granted you may subsequently apply to sit that module(s). Similarly, if you obtain new qualifications at a later date, you may re-apply for exemption.

To apply for Individual Exemption you must submit your application on the Application for Exemption form, accompanied by the relevant documents and fee. On receipt of this documentation, your application will be assessed to determine whether exemption is feasible. If it is, your case will be submitted to an assessor for review. The assessor will decide whether to recommend your case for exemption. Please note that exemption is not guaranteed.

Applications are assessed against the relevant part(s) of the BCS Professional Examination syllabus. Although other qualifications are unlikely to conform exactly to the syllabus, the assessor will consider whether the knowledge gained from the qualification(s) held would enable you to pass any module or part of the BCS Professional Examination. For example, in order to award exemption from the Certificate the assessors must be satisfied that you have gained knowledge equivalent to the Information Systems, Software Development and Technology modules from the qualification you present.

If necessary, applications for exemption from several modules will be considered by assessors with expertise in each particular field. Assessors are required to respond to the BCS within one month of receiving an application.



EXAMINATION REGULATIONS AND NOTES FOR GUIDANCE

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INTRODUCTION

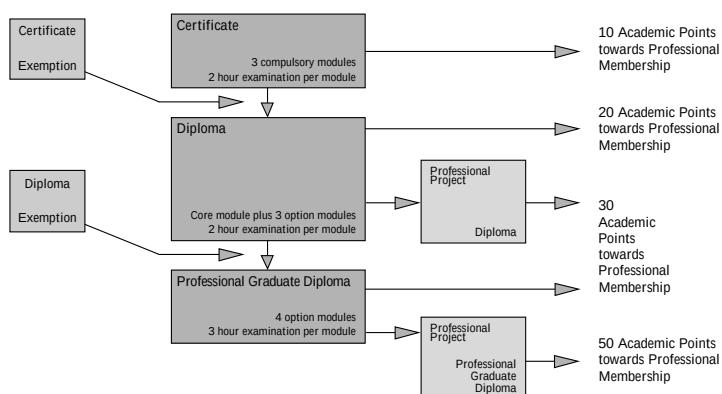
These Regulations and Notes for Guidance should be read in conjunction with the Syllabus for the BCS Professional Examination, which is reviewed and published annually.

The latest versions of the Regulations and Syllabus are also on the BCS website at the following address:

www.bcs.org.uk/exam

REGULATIONS

1 Structure of the Examination



The Examination has a modular structure with three levels. There is one examination paper per module:

Certificate: Three compulsory modules, each paper of two hours' duration.

Diploma: One compulsory core module and three modules chosen from a list of options, each paper of two hours' duration.

Professional Graduate Diploma: Four modules chosen from a list of options, each paper of three hours' duration. Alternatively, a dissertation may be offered.

Professional Project (Diploma level) or Professional Project (Professional Graduate Diploma level):

By passing, or being exempted from the Certificate, the Diploma and the Professional Project (Diploma level or Professional Graduate Diploma level), the candidate can achieve 30 academic points towards professional membership of the BCS.

By passing, or being exempted from, the Certificate, the Diploma, the Professional Graduate Diploma (by examination or dissertation) and the Professional Project (Professional Graduate Diploma level), the candidate will achieve 50 academic points towards Professional Membership of the BCS.

1.1 CERTIFICATE

The examination will consist of a two hour written paper on each of the three compulsory modules:

Information Systems

Software Development

Technology

1.2 DIPLOMA

The examination will consist of a two hour written paper on the compulsory core module, *Professional Issues in Information Systems Practice*, and a two hour written paper on each of the three modules chosen from the list of specialist options. The list of options is given in the Syllabus and is kept under review by the BCS.

1.3 PROFESSIONAL GRADUATE DIPLOMA

Candidates may take the Professional Graduate Diploma by written examination or by submission of a dissertation.

Examination

The examination will consist of a three hour written paper on each of four modules chosen from a list of specialist options. The list of options is given in the Syllabus and is kept under review by the BCS.

Dissertation

In place of the examination, a candidate may submit a dissertation on a topic which has been agreed by the BCS.

The Dissertation must be an individual report. Two or more people may work on the same project, provided it is of sufficient size, but each candidate must individually satisfy the regulations and the Dissertation must clearly identify the candidate's individual contribution.

1.4 PROFESSIONAL PROJECT

General

The Professional Project may be undertaken at Diploma level or at Professional Graduate Diploma level, according to the qualification aim of the candidate. Any candidate who has passed the Professional Project at Diploma level cannot resubmit the same project at Professional Graduate Diploma level.

Exceptionally, a candidate who submits a project at Professional Graduate Diploma level may be offered a pass at Diploma level. If the candidate accepts the pass at Diploma level it will not then be possible to resubmit the project at Professional Graduate Diploma level.

The Professional Project must be authenticated using the forms provided, preferably by a Fellow or Member of the BCS. If a Fellow or Member of the BCS is not available, then evidence of the authenticator's professional competence in information systems must be supplied by means of a curriculum vitae.

The report should be submitted in a folder (or binder) identified by the name and, where applicable, membership number of the candidate and clearly stating the level of the project (either Diploma or Professional Graduate Diploma).

Professional Project (Diploma Level)

Candidates will submit a report on the practical implementation of a computer-based project (as defined below).

- The Professional Project should involve the development of a computer-based solution to a practical problem. This will normally, but not necessarily, involve the candidate in the production of software.
- The Professional Project may be part of a group project but each candidate must individually satisfy all the requirements and the report must clearly identify the candidate's individual contribution.
- The size of the report should be approximately 5,000 words excluding appendices.

Professional Project (Professional Graduate Diploma Level)

Candidates will submit a report on the practical implementation of a computer-based project (as defined below).

- The Professional Project should involve the development of a computer-based solution to a practical problem. The report must put the problem in context, include a survey of relevant literature, and provide a list of references.
- The Professional Project should be an individual piece of work undertaken by the candidate alone. Group projects are not allowed.
- The size of the report should be approximately 10,000 words excluding appendices.

2 Eligibility

There are no formal entry requirements for any part of the Examination. However, candidates are strongly urged to read the accompanying Notes for Guidance and to take account of any prior knowledge expected in the Syllabus.

3 Entry for a Module, Project or Dissertation

There is no requirement to register with the BCS prior to

entry for the Examination. Both members and non-members of the BCS may enter for any part of the Examination. There is currently one sitting each year for the Professional Graduate Diploma written examinations, in April/May. A timetable is published during the preceding July. The certificate is examined twice a year in April and October, as are popular Diploma modules.

3.1 ENTRY FOR A MODULE OR PROFESSIONAL PROJECT

Applicants wishing to enter for one or more modules in a particular sitting or wishing to submit a Professional Project in a particular year must comply with the following conditions:

Applications for entry for a module or project submission must be submitted on the BCS Professional Examination entry form and be accompanied by the correct fees.

Entry forms for written examinations and Professional Project reports must be submitted by the appropriate closing dates:

April sitting

- Overseas candidates by 6 January.
- UK and Republic of Ireland candidates by 15 January.

There will be earlier closing dates for candidates wishing to sit at non-standard venues. (See page 5.) Examination Venues.

October sitting

- All candidates by 15th August.
- There will be earlier closing dates for candidates for candidates wishing to sit at non-standard venues. (See page 5.) Examination Venues.
- Professional Project reports by 31 January.
- The Professional Graduate Diploma by Dissertation may be submitted at any time through the year.

Late or incomplete entries will not normally be accepted. In exceptional circumstances, at the discretion of the Examinations Manager, a fee may be charged for processing such entries.

Once applications have been processed, the fees will not be refunded.

Candidates who allow their BCS membership to lapse will be required to pay the non-member entry fee or reinstate their membership.

3.2 ENTRY FOR PROFESSIONAL GRADUATE DIPLOMA BY DISSERTATION

Applications for the Professional Graduate Diploma by Dissertation must be submitted on the BCS Professional Examination entry form and be accompanied by a dissertation abstract and the correct abstract assessment fee.

4 Method of Completion

4.1 SEQUENCE OF MODULES AND PROJECTS

Modules may be taken in any sequence but candidates are strongly urged to read the accompanying Notes for Guidance and to take account of any prior knowledge expected in the Syllabus. Notice should also be taken of the regulations for certificates to be awarded which are listed in Section 6. Professional Projects may be submitted before, during or after attempting the written examinations.

4.2 NUMBER OF ATTEMPTS

There is no limit to the number of attempts that may be made at written examinations or Professional Project submissions but fees are payable for each attempt. Only one Professional Project submission is allowed in any calendar year.

4.3 PROFESSIONAL GRADUATE DIPLOMA BY DISSERTATION

A candidate wishing to take the Professional Graduate Diploma by dissertation must submit to the BCS the title and plan of the proposed dissertation, together

with a 500-word description of the proposed work, in abstract form.

The candidate will be informed by the BCS whether the proposed dissertation is acceptable. If accepted, the candidate will be given three years to submit the dissertation. No extension will normally be granted to this submission date.

If the abstract is not acceptable, the candidate will be advised whether to resubmit for re-approval or attempt the Professional Graduate Diploma by examination.

A candidate whose dissertation proposal has been rejected is free to submit a revised version of the proposal or a completely new proposal. A fee will be payable in either case.

Two copies of the dissertation must be submitted together with the correct entry fee. They must be word-processed or type set in double line spacing, on A4 paper and bound in hard covers with the title of the dissertation, the name of the candidate and the date of submission on the front. The dissertation should be paginated and subjected to a spelling checker. The total length of the dissertation, excluding appendices, must not exceed 20,000 words.

If the candidate is successful, the BCS will retain one copy of the dissertation.

The BCS may, at its discretion, require a candidate to make modifications to the dissertation and to resubmit within a time scale set by the BCS. A fee will be payable on resubmission.

In addition to being assessed for the Professional Graduate Diploma by dissertation, if the dissertation meets the requirements of the Professional Project (at Diploma or Professional Graduate Diploma level), it may be assessed as such.

4.4 ORAL EXAMINATION

The BCS reserves the right to require a candidate to undergo an oral examination following the sitting of an examination or the submission of a Professional Project or dissertation.

5 Pass Marks

The pass mark for all modules is 40%.

6 Certificates

In addition to the Certificate, Diploma, Professional Graduate Diploma and Professional Project, certificates will also be awarded, on request, for passing individual modules.

Awards will be made to both members and non-members of the BCS.

Certificates, Diplomas and Professional Graduate Diplomas will only be awarded to those candidates who have passed, rather than been exempted from, at least half of the required number of modules. However, a transcript will be issued in all cases.

Diplomas will only be awarded to those candidates who have passed, or been exempted from, the Certificate. Professional Graduate Diplomas will only be awarded to those candidates who have passed, or been exempted from, the Certificate and the Diploma.

7 Fees

Fees will be payable for the following:

- Entry to a written examination;
- Submission and resubmission of a Professional Project;
- Submission and resubmission of a dissertation abstract;
- Submission and resubmission of a dissertation;
- Issue of a module certificate.

Fees are reviewed and published annually.

There are differential fees for members and non-members of the BCS. To be eligible for the member rate, a candidate must be a current member (at any grade) of the BCS or else must apply for membership at the time of entry.

8 Mitigating Circumstances

Any candidates who believe they have mitigating circumstances with regard to their examination performance must write to the Examinations Manager, explaining the circumstances, within three weeks of the examination. Appropriate supporting evidence e.g. a bona fide medical certificate must be included with the correspondence.

9 Appeals

The BCS operates an appeals system. Details are available from the Examinations Manager of the BCS on written request.

NOTES FOR GUIDANCE

1 Academic Level of the Examination

1.1 CERTIFICATE AND DIPLOMA

The Diploma is examined to the academic level of a Higher National Diploma. The Certificate is examined to the academic level of the first year of a Higher National Diploma.

1.2 PROFESSIONAL GRADUATE DIPLOMA

The Professional Graduate Diploma is examined to the academic level of a university honours degree.

1.3 PROFESSIONAL GRADUATE DIPLOMA BY DISSERTATION

The Professional Graduate Diploma by Dissertation is examined to the standard expected of a higher degree dissertation (MSc rather than PhD).

1.4 PROFESSIONAL PROJECT (DIPLOMA LEVEL)

The Professional Project (Diploma level) is examined to the level expected of a Higher National Diploma project.

1.5 PROFESSIONAL PROJECT (PROFESSIONAL GRADUATE DIPLOMA LEVEL)

The Professional Project (Professional Graduate Diploma level) is examined to the level expected of a university honours degree project.

2 The Syllabus and Regulations

The Syllabus is kept under review to ensure that it remains up to date and relevant to the needs of information systems professionals. New optional modules may be added and updates made to existing modules each year. Two years' notice will be given both for changes to the structure of the Examination and for the discontinuation of modules.

3 The Professional Project (Diploma and Professional Graduate Diploma Level)

3.1 PURPOSE

The purpose of the Professional Project at Diploma and at Professional Graduate Diploma level is to demonstrate an appropriate level of professional competence in the development of a suitable computer-based system. In order to demonstrate this fully, it is desirable that the project be "real" in the sense that the end product can be used to do a real job for users other than the author. A development for use by the candidate alone, a collection of course exercises, a literature search, or a descriptive evaluation is unacceptable. If possible, the project should come from the candidate's normal work.

All Professional Projects will be expected to demonstrate that the work undertaken is of professional quality and value to the customer. If a candidate is not sure that their proposed Professional Project is suitable, or if the project contains material of a confidential nature, the candidate is invited to contact the BCS Examinations Office for advice.

3.2 RECOMMENDED HOURS

The Professional Project at Diploma level should reflect approximately 100 hours of work and, at Professional Graduate Diploma level, approximately 150 hours of work. Both figures exclude the time to write the report.

3.3 STRUCTURE

The Professional Project report should convey to the examiners the nature of both the product itself and the process by which the product was produced. The report must contain:

- Abstract – a brief summary of the Professional Project, describing its nature and scope.
- Requirements Analysis and Specification – how the specification was created, communication with the users/owners, constraints, rationale for choices made, the specification itself, and the initial work schedule.
- Design – how the product was designed, including design method, design process and outcome. This should include the rationale for design decisions and trade-offs made, such as selection of algorithms, data structures and implementation environments as appropriate.
- Implementation – how the product was produced, including choice of language, packages, tools and development environments and a recognition of the importance of relevant documentation.
- Testing – how the product was debugged, tested and evaluated, as appropriate, to demonstrate that the specification has been satisfied.
- Critical appraisal – a review of the Professional Project looking back at both the product and the process. This should include an analysis of the major design, implementation and testing decisions, lessons learnt by the candidate during the course of the Professional Project, and an analysis of the strengths and weaknesses of the product and the process.

The above list does not imply that a particular method or approach has to be adopted. Any professional approach is acceptable but the report must address the above issues.

3.4 ROLE OF CANDIDATE

It is not expected that all Professional Projects will involve candidates equally in the stages of specification, design, implementation and testing. It is recognised that a candidate might not have been able to implement the end product personally. Nevertheless, the candidate must have played a significant role in the testing and implementation. The candidate is expected to have personal involvement in the demonstration of the product's "fitness for purpose".

It is a requirement for all Professional Projects that they contain aspects of implementation. For Professional Projects centred on hardware development, systems analysis or programming, this requirement can be satisfied by a description of the implementation and testing phases. For Professional Projects centred on "management" issues such as feasibility studies, procurement exercises or computer auditing, the requirement can be satisfied by the prior creation of a set of criteria for acceptance and a set of procedures and tests to determine whether the criteria have been satisfied. As long as the candidate participates in the creation of the criteria and the subsequent acceptance testing, such Professional Projects are in general acceptable.

3.5 PLAGIARISM

Plagiarism consists of passing off the work or ideas of others as your own. It is a clear breach of clauses 3 and 11 of the Society's Code of Conduct and may also, in some circumstances be in breach of clause 15. In the context of the Society's examinations, specifically the Project, plagiarism would include, for example: unattributed quotation from a public source, including the World Wide Web; copying material from other people, e.g., colleagues, without acknowledgement; copying or reuse of designs, programs, or other source material without acknowledgement; submission of work jointly produced with someone else as if it were entirely your own work.

No intellectual endeavour is ever absolutely original. Even the most original minds depend on the thoughts and discoveries of their predecessors. And, in information systems engineering, team work is an essential element of most developments. There is therefore no objection to using other people's work as part of your project. The important thing is that you should make clear in your project report what is your own work and what is the work of other people.

The following simple guidelines are intended to help you avoid straying from legitimate and desirable co-operation into the area of plagiarism:

- if your project uses work that has been done by your colleagues, include a section in your report, entitled "Acknowledgements", which explains just what is your own work and what is the work of others;
- append a bibliography to your work listing all the sources you have used, including electronic sources and documents such as company standards manuals;
- surround all direct quotations with inverted commas, and cite the precise source (including page numbers or the URL and the date you accessed it if the source is on the Web) either in a footnote or in parentheses directly after the quotation;
- use quotations sparingly and make sure that the bulk of the work is in your own words;
- if you are reusing code or design information from another source, never remove annotation that identifies the original author, even when you are modifying the code;
- remember that it is your own input that gives a piece of work merit. Whatever sources you have used, the structure and presentation of the argument should be your own. If you are using electronic sources, don't cut and paste sections into your work. If you are using books or papers, put them aside when you actually sit down to write. In this way you won't be tempted to copy in material that you don't understand, or be at risk of unintentionally copying in more material than a brief quotation, or of accidentally leaving quotations unmarked.

The BCS goes to some trouble to detect cases of plagiarism in project submissions and there is a very real chance that it will be detected. The BCS will take a very serious view of any cases of plagiarism that are found.

4 Professional Graduate Diploma by Dissertation

Candidates intending to take the Professional Graduate Diploma by Dissertation are strongly advised to consult the Dissertation Guidance Notes which are available on the web or from Customer Support then seek appropriate advice from the BCS Examinations Office at the earliest possible opportunity.

No hard and fast rules can be laid down regarding the content of the dissertation or the nature of the work described. Anything from original research in the foundations of computer science to an application system development can be acceptable. In assessing dissertations, the examiners will be looking for evidence of professional competence appropriate to the field in which the work lies.

The following general points can be made.

- the ability to express oneself clearly, concisely and correctly in writing is inherent in the notion of professional competence and dissertations which fail in this respect will not be accepted;
- where the work described includes contributions from other people, candidates must make it completely clear precisely what work they carried out themselves;
- the work described must involve the equivalent of at least six months' full-time work by the candidate;
- the context of the work must be clearly described.

Where the work described is of a research nature, the appropriate style is that of a dissertation for a higher degree, including a summary of related work and appropriate references.

Where the work described is an application system development, the full development cycle, from requirements analysis through to acceptance testing and post-implementation review should be described; the candidate should have been personally involved in most of the phases.

A scholarly appraisal of the state of the art in a particular area or a critical evaluation of a number of competing products is acceptable.

Candidates are advised, however, that such work is not easy. Real insight is required; a dissertation, which merely summarises a number of published modules or the facilities offered by competing products, will not be acceptable.

Candidates should note that the evaluation of dissertation proposals will normally take about six weeks and the assessment of dissertations about three months.

5 Eligibility

There are no formal entry requirements for the Examination and applicants are expected to determine their own suitability for each module for which they enter. The following notes are offered for guidance.

- Candidates will be expected to have a standard of general education equivalent to the UK GCE A level. This means that candidates will generally be at least 19 years of age and have completed the equivalent of 12 years of schooling before they attempt the BCS Professional Examinations. Candidates must have adequate ability to communicate in English.
- Candidates will be expected to draw on practical experience when answering examination questions, particularly at the Professional Graduate Diploma level.
- Examination questions at both Diploma and Professional Graduate Diploma level will assume knowledge of the subject areas covered by the Certificate modules.
- Prior knowledge expected for specific modules will be listed in the Syllabus.

6 Study Hours

The examiners recommend the following numbers of hours study time:

Certificate and Diploma: 140 hours per module.

Professional Graduate Diploma: 200 hours per module.

These are total hours and include tuition, self-study, assignments and exercises.

7 Study Mode

A formal course of instruction, whether by attendance or distance learning, is not mandatory. The BCS operates a course recognition process. Recognition is granted to courses on an individual module basis. Only courses which satisfy the BCS's conditions are indicated in BCS literature as being "BCS recognised". Some course providers may run courses which have been recognised and others which have not. Candidates are advised that examinations of this type should not be undertaken without adequate preparation.

8 Use of Calculators

Candidates are permitted to use their own electronic calculators for all examinations. However, they should be aware that these are not 'open book' examinations and therefore any memory store must be empty before the start of the examination.

9 Instructions for Candidates at Examination Venues

Candidates will receive 'Instructions to Candidates' with their examination admission letters. These instructions relate to candidates' conduct at the examination venue and should be read carefully.

Section 3

SYLLABUS

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CERTIFICATE

1 Information systems

Rationale:

This module covers the following topics: systems analysis and design, database systems, data analysis and management, systems and organisations.

Aims:

- To develop an awareness of the nature and use of information and information systems in an organisational context
- To introduce the various techniques used within systems analysis and design
- To foster an appreciation of the different types of methodologies used in the system development process
- To provide an introduction to database management systems

Objectives:

- Show an understanding of the flow of information within organisations
- Understand the differing types of information
- Propose practical solutions to given analytical problems
- Demonstrate the effective use of a chosen methodology through requirements analysis and fact finding techniques
- Display an awareness of systems development tools and techniques
- Become conversant with system design issues
- Develop awareness of the basic ideas behind using a computer to store and manipulate data
- Display knowledge of data analysis and modelling techniques
- Discuss various database management architectures
- Demonstrate an awareness of Human Computer Interaction and the use of multimedia and hypermedia
- Suggest suitable testing strategies and implementation techniques

Prior Knowledge Expected:

None

Content:

1 DATA MANAGEMENT

The nature of information; its acquisition, presentation, storage and management

Characteristics of data; data capture and collection

Data processing and data modelling

Simple statistical measures: mean, mode, median, standard deviation

Tabular representation of data.

Histograms, interpolation

Requirements analysis and prototyping

Fact finding methods

Security, integrity and control

File management; organisation and access methods

Database design issues; entity modelling, normalisation, logical/physical mapping

Database architectures and types of database management systems

Functions of database management systems and database administration

Introduction to multimedia and hypermedia

2 SYSTEMS ANALYSIS AND DESIGN

The systems development life-cycle and its implications for software design, coding, testing, implementation and support

Prototyping and systems development tools

Structuring systems analysis and design techniques

Hard and soft system methodologies

Rapid application development and prototyping techniques

Object-oriented modelling

Human computer interface (HCI) design aspects

3 ORGANISATIONS

The flow of information in an organisation

Basic idea of management functions and structure of business and other organisations

Personnel and social considerations in the consideration of new systems

Management of computer systems, staffing, maintenance, project management and scheduling

Quality assurance aspects and methods

Primary Texts:

Avison, D., Golder & Shah, H., *The Information Systems Development Life Cycle*, McGraw-Hill (2nd Ed), 2001, ISBN: 0-07-7092449

This book takes a basic approach to developing information systems. Avison's other books go into more detail than necessary for this syllabus.

Date, C. J., *An Introduction to Database Systems*, Addison-Wesley (7th Ed), 2003, ISBN: 0-3211810-2

One of the standard works on database systems.

Candidates should concentrate on the basic concepts of database and database design.

Kendall, K & Kendall, J. E., *Systems Analysis & Design*, Prentice-Hall (5th Ed), 2001, 0-13-042365-3

Other Texts:

Graham, I., *Object-oriented Methods*, Addison-Wesley (3rd Ed), 2000, ISBN: 0-20161913-X

Goodland, M. & Slater, C., *SSADM: A Practical Approach*, McGraw-Hill, 1995, ISBN: 0-07-709073-X

Rolland, F. D., *The Essence of Databases*, Prentice-Hall, 1998, ISBN: 0-13-727827-6

Nickerson, R. C., *Business and Information Systems*, Addison-Wesley (2nd Ed), 2003, ISBN: 0-13-090122-9

Britton & Doake, *Software Systems Development – A Gentle Introduction*, McGraw-Hill, 2002, 0-07-7099745

Geoffrey Elliot & Susan Starkings, *Business Information Technology*, Pearson, 1997, 0-58229802-4

Other Reading:

The computer trade press and the computing/IT supplements of newspapers will help to give candidates both an understanding of the scope of the discipline and introduce new developments in the field.

2 Software development

Rationale:

Programming, using many styles and languages, provides solutions to a wide variety of scientific, engineering and business problems. Programming is a core skill that will be used throughout a computer practitioner's career. It is a skill acquired largely by practice and experience. Learning how to program requires a disciplined and structured approach in order to encourage good practice and to assist in the development of easily maintained systems. This module introduces candidates to the fundamental concepts of programming with the emphasis being laid on the whole of the software development process.

Aims:

- To stress the importance of good design, documentation and usability
- To emphasise skills in problem solving and algorithm specification rather than just writing syntactically correct code
- To introduce a systematic approach to algorithm development which will assist in subsequent programming and system design modules

- To introduce candidates to the environment in which software is developed and to the tools that assist in this process

Objectives:

- Distinguish between systems software and application software
- Understand the phases of software development
- Demonstrate a knowledge of a visual or 3rd generation high level programming language
- Develop competence in the techniques of systematic problem analysis, program construction and documentation
- Gain an understanding of the basic concepts of good user-interface design
- Be able to test and document programs
- Gain an understanding of the principles of multiple module program construction
- Understand the need for compilers, interpreters, code generators
- Develop a knowledge and understanding of a range of fundamental algorithms

Prior Knowledge Expected:

None

Content:

- FUNDAMENTAL CONCEPTS OF THE PROGRAMMING PROCESS**
Concept of an algorithm
Development and semi-formal specification of algorithms, based on a simplified computer model
Understanding of sequential and parallel processing
- PHASE-SPECIFIC ISSUES OF SOFTWARE DEVELOPMENT**
Development tools such as code generators, design modelling or test generators
Development techniques such as modular programming, defensive programming or recursion
Approaches to software build, such as evolutionary prototyping or 4GL development
Objectives and principles of testing and test-case specification
Testing and debugging strategies including dry-running, white-box and black-box
Styles of software documentation, such as for users or support personnel
Content of software documentation such as GUI descriptions or maintenance details
- INTRODUCTION TO PROGRAMMING CONCEPTS**
Types: numeric and non-numeric, elementary and derived, subtypes, and expressions such as assignments, input/output
Control structures: selection and iteration
Subprograms: procedures and functions
Data structures: Arrays (1- and 2-dimensions), linked lists using pointers; implementation of queues, stacks and lists. Concept of data abstraction
Sorting and searching algorithms: comparative effectiveness with respect to computation and storage of scanning versus indexing methods
- FILES: SEQUENTIAL, INDEX-SEQUENTIAL AND RANDOM ACCESS**
Comparative effectiveness of storage and retrieval for applications such as batch processing or on-line query or both
- INTRODUCTION TO CONCEPT OF USER-INTERFACE DESIGN**
User requirements and characteristics of user interfaces; principles and techniques of dialogue control, navigation and selection
- ROLE AND NEED FOR SYSTEM SOFTWARE**
System software and its relation to application software
- CASE STUDIES IN PROBLEM SOLVING/ALGORITHM ANALYSIS**

Primary Texts:

Shackleford, R. L., *Introduction to Computers and Algorithms*, Addison Wesley, 1998, ISBN: 0-201-31451-7
A solid foundation to the study of algorithms in computer science

Bell, D. **Software Engineering: A Programming Approach**, Addison Wesley (3rd Ed), 2000, ISBN: 0-201-65856-3

Recommended for reading more about software engineering and structured design concepts in programming

Indicative Programming Texts:

Bishop, J. *Pascal Precisely for Scientists and Engineers*, Addison Wesley (2nd Ed), 1990, ISBN: 0-201-41692-1

A 'teach by example' text for engineering and science students taking introductory programming courses

Gottfried, B.S. *Schaum's Outline of Theory and Problems of Programming with C*, Schaum (2nd Ed), 1996, ISBN: 0-07-024035-3

Horstmann, C.S. *Computer Concepts with Java Essentials*, Wiley, 2002, ISBN: 0-471-37980-8

Deitel, Harvey, *Java How to Program*, Prentice Hall (5th Ed), 2003, ISBN: 0-13-120236-7

Schneider, D.I., *An Introduction to Programming Using Visual Basic 5.0*, Prentice Hall (3rd Ed), 1998, ISBN: 0-13-030657-6

Other Reading:

Other textbooks that describe introductory programming will be appropriate. The computer trade press and the computing/IT supplements of newspapers will help to give candidates both an understanding of the scope of the discipline and also introduce new developments in the field.

3 Technology

Rationale:

This module provides a foundation for all professional computer personnel in computer technology and related topics, in particular the areas of: number systems, hardware, systems software, networks and system performance measurement.

Aims:

- To develop an understanding of the principles underlying the construction of computer systems
- To evaluate critically the performance measurement data quoted for PC systems
- To introduce the fundamental building blocks of all digital computers and the descriptive functionality of attached hardware

Objectives:

- Use the principles of digital logic and Boolean algebra to implement the most elementary and fundamental of the computer's basic building blocks
- Use instructions and simple addressing modes to execute a program
- Read the specification details for a PC system and understand and interpret them as performance indicators, and explain them in broad terms to non-computer personnel
- Show familiarity with the memory hierarchy of a computer system and devices associated with it
- Describe the principles behind, the choices between, and the functionality of peripheral devices commonly used with PC systems
- Understand the functionality and purpose of compilers and compiler types, invocation parameters, resource requirements, error-reporting methods
- Use the Internet for information searches and utilise some exemplary Internet technologies
- Gain a background knowledge of modern digital communications, including contemporary protocols and standards

- Critically review area networks (LANs and WANs) their design implementations and their bandwidth limitations with performance capabilities
- Correlate all the different measures of performance studied and derive an estimate of system performance

Prior Knowledge Expected:

None

Content:

1 FUNDAMENTALS

Elementary material on number systems (e.g. binary, octal, hexadecimal), two's complement arithmetic, floating point number representation (range and precision) elementary floating-point operations, binary/decimal conversion

Gates (AND, OR, NAND, NOR, inverter)

Sequential logic (D flip-flops, RS flip-flops, JK flip-flops)

Simple circuits (Full adder, multiplexer, shift register, counter)

Boolean algebra, logic diagrams, expressions, truth tables

Sets, logical operations

2 MICROPROCESSOR ARCHITECTURE

Stored program, CPU, ALU, block diagram of processor and essential functions

The processor: simple RISC-like instruction set and functions; CISC processors

Assemblers

Storage/Memory: RAM, ROM, cache, backing store

Disc units, measures of capacity and performance

Optical devices (CD and DVD)

Peripheral devices and characteristics

Bit-mapped graphics display (VDU); printer (different types, speeds, costs); keyboard, mouse, joystick, modem, barcode reader

Relation between peripheral and its controller; interface to CPU

Memory-mapped registers and interrupt line

3 FUNCTIONS OF OPERATING SYSTEMS

Interrupts, concurrency, scheduling, memory management, resource allocation

Input/output subsystems

4 SYSTEMS SOFTWARE

Compilers, interpreters, filestore managers: characteristics, available facilities, resource requirements
Electronic mail, file transfer

The Internet: accessing procedures, World Wide Web (WWW), available information, browsing

5 NETWORKS

Communication principles; characteristics of transmission media and network topologies

Modems: brief principles and characteristics, errors and error detection

Networks (LANs and WANs); Ethernet, media access control, frame formats, repeaters, bridges and routers; brief coverage of datagrams and virtual circuits; addressing, switching and routing

6 CAPACITY PLANNING, PERFORMANCE, RELIABILITY

Definitions, measurement, benchmarks

Critical factors in hardware and software performance, historical and future trends

Primary Texts:

Capron, H. L., *Computers (Tools for an Information Age)*, Addison Wesley (7th Ed), 2001, ISBN: 013-070076-2
Introductory book – sets the module in context. Also covers systems software.

Clements, A., *The Principles of Computer Hardware*, Oxford University Press (3rd Ed), Jan 2000, ISBN: 0-19-856453-8

Covers fundamentals and architecture in detail.

Tanenbaum, Andrew, S., *Modern Operating Systems*, Prentice Hall, (2nd Ed) 2001, ISBN 013-092641-8

Covers operating systems and some networks.

Other Texts:

Comer, D. E., *The Internet Book*, Prentice Hall (3rd Ed), 2000, ISBN: 013-030852-8

Halsall, F., *Data Communications, Computer Networks & Open Systems*, Addison Wesley, 1995,

ISBN: 0-201-42293-X

Covers the networks material in considerable depth.

Tanenbaum A. S., *Computer Networks*, Prentice Hall (4th Ed), 2002, ISBN: 013-394-248-1

Tanenbaum A. S., *Operating Systems Design and Implementation*, Prentice Hall (2nd Ed), 1997, ISBN: 013-630-195-9

William Buchanan, Austin Wilson, *Advanced PC Architecture*, Addison-Wesley, 2001, ISBN: 0-201-39858-3

Other Reading:

The computer trade press and the computing/IT supplements of newspapers will help to give students both an understanding of the scope of the discipline and introduce new developments in the field.

DIPLOMA

1 Core module: Professional issues in information systems practice (Version 2 – New)

This syllabus represents a major change compared with the original. This Version 2 syllabus will be first examined in April 2004 and thereafter, twice a year.

Rationale:

In order to function effectively, professional Information Systems Engineers need not only appropriate technical knowledge, skills and experience, but also a broad understanding of the context in which they will be expected to work. This does not mean that they must become experts in these areas (although those who go on to assume substantial management responsibilities may later need to acquire professional knowledge and expertise in some of them).

Aims:

- To understand the context – ethical, social, legal, financial and organisational – in which professional Information Systems Engineers work

Objectives:

- Show an understanding of the role of professional codes of conduct and apply them to specific situations
- Understand the nature and legal standing of a range of organisations
- Understand the range of functions that exist in an organisation, the need for organisational structure and the characteristics of various types of structure
- Understand and read, at a basic level, a balance sheet, a profit and loss account, and a cash flow statement
- Understand and calculate, in simple cases, the basic information needed for day-to-day financial management
- Understand the main pieces of legislation that apply to the profession and recognise situations to which they are relevant
- Understand the mechanisms used to protect computer software and the reasons for such protection

Prior Knowledge Expected:

Candidates are expected to be familiar with the material covered in the Certificate syllabuses and to have an appreciation of current affairs such as may be obtained by regular reading of a serious newspaper or news magazine.

Content:

1 PROFESSIONAL INSTITUTIONS

The role of professional institutions and their characteristics: established by Royal Charter, self-governing, controlling entry to the profession and maintaining discipline; reservation of title and reservation of function. Some familiarity with the best-known professional institutions (e.g. those governing the law, medicine and accounting) will be expected.

The development and structure of the engineering profession; the roles of the Engineering Council and the professional engineering institutions. Regulation of the engineering profession outside the UK.

The British Computer Society and its membership structure; branches and specialist groups.

2 ORGANISATIONS AND THEIR STRUCTURE

Limited companies and the roles of directors and members; the advantages of limited company status for commercial organisations. Other legal forms of organisation.

The concept of delegation and specialisation. Management structures: structure by function, by product, by market sector, and by region.

3 FINANCE

The financial structure of companies. The requirements for financial disclosure imposed by statute and by stock exchanges. Capital items and depreciation. The balance sheet, the profit and loss account, and cash flow statement.

4 MANAGEMENT ACCOUNTING

Costing: direct and indirect costs; fixed and variable costs; overheads, corporate and divisional. Treatment of overheads in costing. Costing of labour. Costing (as opposed to estimating) of IT projects. The effect of cost and other factors on the pricing of software.

Cash flow and its importance; cash flow forecasts, the need for working capital.

Discounted cash flow analysis and its use in the assessment of capital projects.

Simple budgeting.

5 LEGAL OBLIGATIONS

Data Protection Acts 1984 and 1998. Computer Misuse Act 1990. Relevant provisions of the Consumer Protection Act 1987, the Health and Safety at Work Act 1974, the Disability Discrimination Act 1995 and the Regulation of Investigatory Powers Act 2000.

6 INTELLECTUAL PROPERTY

The concept of intellectual property; software, documentation and designs as intellectual property. The mechanisms available to protect intellectual property. The Copyright, Designs and Patents Act 1988. The EC directive on the Legal Protection of Computer Programs, 91/250.

7 THE INTERNET

The application of the law relating to issues such as privacy, defamation, and intellectual property rights to the Internet.

8 PROFESSIONAL CODES OF CONDUCT AND THEIR LIMITATIONS

Professional Codes of Conduct, their strengths and weaknesses. The BCS Code of Conduct and its application in practice.

9 HUMAN RESOURCES MANAGEMENT

The statutory framework of employment. Contracts of employment. Legal issues arising from outsourcing.

The BSC industry structure model; continuing professional development.

Recruitment and selection. Equal opportunities practices. Human resources planning.

The effect of information systems on jobs. Job design: specialisation, rotation, enlargement and enrichment. Job evaluation.

Appraisal and Management by Objectives. Continuing professional development.

Remuneration schemes, planning and control.

As indicated, some of the books mentioned here are out of print. They are included because they are still relevant and useful and can be found in many libraries.

There is no single book that covers the whole of this syllabus at an appropriate level.

The two articles from Comm ACM are journal articles so they are not available for purchase except as part of a subscription to the journal. One information source would be the local university library where the relevant articles can be photocopied. (The ACM allows unlimited copying for educational purposes.)

Bott, Frank *et al*, *Professional Issues in Software Engineering*, Taylor and Francis (3rd Ed), 2001, ISBN: 0-7484-0951-3

This book covers all of the syllabus, and does so in the context of software engineering; the coverage of organisational structure and human resource management is, however, limited. Further, it is intended for practising software engineers and final year students on honours degree courses; it may therefore be too sophisticated for some candidates at this level.

Ayres, Robert, *The Essence of Professional Issues in Computing*, Prentice Hall, 1999, ISBN: 0-13-908740-0

This is a very readable book that may be found more approachable for students at this level than Bott *et al*. There is, however, no coverage of sections 2, 3, 4 and 8 of the syllabus.

Myers C. (Ed), *Professional Awareness in Software Engineering*, McGraw-Hill, 1995, ISBN: 0-07-707837-3 (out of print)

This is a collection of essays by different authors on some of the topics covered in the module. The best of the essays are stimulating and informative, while being less academic and perhaps more approachable for candidates at Diploma level than the material in Bott *et al*. However, some of the chapters are rather superficial and it covers less than half of the syllabus.

Myers C., Hall T. and Pitt D., (Eds), *The Responsible Software Engineer: Selected Readings in IT Professionalism*, Springer, 1997, ISBN: 3-540-76041-5 (out of print)

This is a collection of papers presented at a conference in 1996. It addresses syllabus sections 1, 4, 6 and, to a limited extent, 8, as well as some topics not covered in this module. As might be expected, the coverage is much deeper than is required here but it can be recommended to students who would like to pursue their studies further.

Candidates should be familiar with the BCS Code of Conduct and with the Software Engineering Code of Ethics produced by the Joint Task Force of the IEEE Computer Society and the ACM. The latter is most readily available from the World Wide Web at <http://www.computer.org/tab/seprof/code.htm>.

As a background to the general question of IT ethics, candidates may find the following article useful:

Laudon K. C., *Ethical Concepts and Information Technology*, Comm ACM, 38(12) pp 33-39. December, 1995.

Although it relates to an earlier version of the ACM Code of Ethics, the following article provides a useful discussion of a set of straightforward scenarios and is written at an appropriate level for candidates for this paper.

Anderson R. E., *et al*, *Using the New ACM Code of Ethics in Decision Making*, Comm ACM, 36(2) pp 98-107. February, 1993

Students looking for more general material on ethics will find the following book useful:

Benn, P., *Ethics*, UCL Press, 1998, ISBN: 1-85728-453-4

Two useful books on ethics in relation to information systems are:

Langford, D. *Practical Computer Ethics*, McGraw-Hill, 1995 (out of print)

Langford, D. *Internet Ethics*, Macmillan, 2000, ISBN: 0333-77-62-67

The British Computer Society publishes a series of 'practical guides for professionals and business managers'. The following are relevant to this module:

Data Protection: Everybody's Business, BCS, 1998, ISBN: 1-902505-04-2

This publication can be downloaded as a PDF file.

Data Protection – implementing the Legislation,
BCS, 2000, ISBN: 1-902505-34-4

Disability Discrimination Act – Access for All,
BCS, 2000, ISBN: 1-902505-20-4

Intellectual Property Rights in Software,
BCS, 2000, ISBN: 1-902505-18-2

These BCS publications are all available from the Society's
Publications Department and an order form is available on
<http://www.bcs.org/publications>

2 Core module: Professional Issues in Information Systems Practice (to be discontinued after April 2005)

Rationale:

In order to function effectively, professional Information Systems Practitioners need not only appropriate technical knowledge, skills and experience, but also a broad understanding of the context in which they will be expected to work. This does not mean that they must become experts in these areas (although those who go on to assume substantial management responsibilities may later need to acquire professional knowledge and expertise in some of them).

Aim:

- To understand the context – ethical, social, legal, financial and organisational – in which professional Information Systems Practitioners work

Objectives:

- Show an understanding of the role of professional codes of conduct and apply them to specific situations
- Understand the nature and legal standing of a range of organisations
- Understand the range of functions that exist in an organisation, the need for organisational structure and the characteristics of various types of structure
- Understand and read, at a basic level, a balance sheet, a profit and loss account, and a cash flow statement
- Understand and calculate, in simple cases, the basic information needed for day-to-day financial management
- Understand the main pieces of legislation that apply to the profession and recognise situations to which they are relevant
- Understand the mechanisms used to protect computer software and the reasons for such protection

Prior Knowledge Expected:

Candidates are expected to be familiar with the material covered in the Certificate syllabuses and to have an appreciation of current affairs such as may be obtained by regular reading of a serious newspaper or news magazine.

Content:

1 PROFESSIONAL INSTITUTIONS

The role of professional institutions and their characteristics: established by Royal Charter, self-governing, controlling entry to the profession and maintaining discipline; reservation of title and reservation of function. Some familiarity with the best-known professional institutions (e.g. those governing the law, medicine and accounting) will be expected.

The development and structure of the engineering profession; the roles of the Engineering Council and the professional engineering institutions.

2 ORGANISATIONS AND THEIR STRUCTURE

Limited companies and the roles of directors and members; the advantages of limited company status for commercial organisations. Other legal forms of organisation.

The concept of delegation and specialisation. Management structures: structure by function, by product, and by region.

3 FINANCE

The financial structure of companies. The requirements for financial disclosure imposed by statute and by stock exchanges. Capital items and depreciation.

The balance sheet, the profit and loss account, and cash flow statement.

4 MANAGEMENT ACCOUNTING

Costing: direct and indirect costs; fixed and variable costs; overheads, corporate and divisional. Treatment of overheads in costing. Costing of labour. Costing (as opposed to estimating) of IT projects. The effect of cost and other factors on the pricing of software.

Cash flow and its importance; the need for working capital.

Discounted cash flow analysis and its use in the assessment of capital projects.

5 LEGAL OBLIGATIONS

Data Protection Acts 1984 and 1998. Computer Misuse Act 1990. Relevant provisions (i.e. those relating to liability) of the Consumer Protection Act 1987, and the Health and Safety at Work Act 1974.

6 INTELLECTUAL PROPERTY

The concept of intellectual property; software, documentation and designs as intellectual property. The mechanisms available to protect intellectual property. The Copyright, Designs and Patents Act 1988. The EC directive on the Legal Protection of Computer Programs, 91/250.

7 PROFESSIONAL CODES OF CONDUCT AND THEIR LIMITATIONS

Professional Codes of Conduct, their strengths and weaknesses.

8 HUMAN RESOURCES MANAGEMENT

The statutory framework of employment. Job design: specialisation, rotation, enlargement, and enrichment. Job evaluation. Appraisal.

9. PROJECT MANAGEMENT

Planning, estimating, monitoring and control. The use of simple graphical techniques such as Gantt charts. Activity networks and critical path analysis.

Primary Texts:

As indicated, some of the books mentioned here are out of print. They are included because they are still relevant and useful and can be found in many libraries.

There is no single book that covers the whole of this syllabus at an appropriate level.

The two articles from Comm ACM are journal articles so they are not available for purchase except as part of a subscription to the journal. One information source would be the local university library where the relevant articles can be photocopied. (The ACM allows unlimited copying for educational purposes.)

Bott M. F. et al, Professional Issues in Software Engineering, Taylor and Francis (3rd Ed), 2000, ISBN: 0-74-840-9513

This book covers all of the syllabus except for project management and does so in the context of software engineering. The material covered corresponds closely to what is required for sections 1 to 5 and section 7 of the syllabus. The coverage of intellectual property and human resources management is much more extensive than this syllabus requires. The book is intended for practising software engineers and final year students on honours degree courses. The style of the treatment (as opposed to the content) may therefore be too sophisticated for some candidates at Diploma level.

Chapter 7 of Pressman R. S. and Ince D., Software Engineering: A Practitioner's Approach, European Adaptation (4th Ed), McGraw-Hill, 2000, ISBN: 0-748409513. Chapter 7 covers all that is required under project management.

Myers C. (Ed), Professional Awareness in Software Engineering, McGraw-Hill, 1995, ISBN: 0-07-707837-3 (out of print)

This is a collection of essays by different authors on some of the topics covered in the module. The best of the essays are stimulating and informative, while being less academic and perhaps more approachable for candidates studying the Diploma than the material in Bott et al. However, some of the chapters are rather superficial and it covers less than half of the syllabus.

Myers C., Hall T. and Pitt D., (Eds), *The Responsible Software Engineer: Selected Readings in IT Professionalism*, Springer, 1997, ISBN: 3-540-76041-5 (out of print)

This is a collection of papers presented at a conference in 1996. It addresses syllabus sections 1, 4, 6 and, to a limited extent, 7, as well as some topics not covered in this module. As might be expected, the coverage is much deeper than is required here but it can be recommended to students who would like to pursue their studies further.

Other Texts:

Candidates should be familiar with the BCS Code of Conduct and with the Software Engineering Code of Ethics produced by the Joint Task Force of the IEEE Computer Society and the ACM. The latter is most readily available from the World Wide Web at <http://www.computer.org/tab/seprof/code.htm>.

As a background to the general question of IT ethics, candidates may find the following article useful:

Laudon K. C., *Ethical Concepts and Information Technology*, Comm ACM, 38(12) pp 33-39. December, 1995.

Although it relates to an earlier version of the ACM Code of Ethics, the following article provides a useful discussion of a set of straightforward scenarios and is written at an appropriate level for candidates for this paper.

Anderson R. E., et al, *Using the New ACM Code of Ethics in Decision Making*, Comm ACM, 36 (2) pp 98-107. February, 1993

Students looking for more general material on ethics will find the following book useful:

Benn P., *Ethics*, UCL Press, 1998, ISBN: 1-85728-453-4

3 Architecture

Rationale:

This module provides the underpinning knowledge of computer hardware and digital communications required to understand the constraints that computer systems necessarily impose on the development of software applications. These constraints are explored at all levels from the interaction of the major system's components down to the individual logic gates from which the latter are constructed.

Aims:

- To understand how data is represented, stored and manipulated in a digital computer
- To gain a clear insight into the principles of operation of digital computers and the interaction between their hardware and software components
- To be able to make reasoned choices of computer equipment in terms of fitness for purpose
- To understand the principles of digital computer communications and the range of services available
- To develop and maintain an understanding of the rapid rate of change in computer hardware technology

Objectives:

- Demonstrate an understanding of the principles of operation of digital computers
- Critically evaluate the hardware specification of computer equipment and identify its interfacing requirements
- Appreciate the different digital communication services that are available and the principles on which they are based
- Adjust to accommodate the rapidly changing technology through their acquired conceptual framework of underpinning principles

Prior Knowledge Expected:

Candidates are expected to be familiar with the material covered in the Certificate syllabuses.

Content:

- 1 **DATA REPRESENTATION**
Number bases
Binary codes for data e.g. ASCII
Computer arithmetic
Error detecting codes
- 2 **DIGITAL LOGIC**
Boolean algebra
Design of simple combinational logic circuits such as decoders and arithmetic circuits
Design of simple sequential logic circuits such as registers and counters
Integrated circuits, relative merits of scales of integration for different applications. Logic arrays, ASICs and full custom VLSI
- 3 **PROCESSOR ORGANISATION**
Structure of CPU at register level
Relationship to software e.g. operating system, compiler, applications
Fetch/execute cycle
Instruction parallelism, concepts of pipelining and superscalar architecture
Performance considerations
- 4 **MEMORY SYSTEMS**
Memory hierarchy from register to backing store
Rationale and principles of cache and virtual memory
- 5 **INPUT/OUTPUT INTERFACING**
Interrupts, software polling, principles and relationship to the operating system
Direct memory access
Device interfaces e.g. RS232, monitor
High performance I/O controllers e.g. disk, graphics
- 6 **COMMUNICATIONS**
Principles of communication
Error detection and correction
Local and wide area networks
Communication services and standards
- 7 **HIGH-PERFORMANCE ARCHITECTURES**
Performance metrics e.g. benchmarks, reliability
Technology trends, current limits and future directions
Alternative architectures e.g. neural nets and more speculative ideas such as the quantum computer

Primary Texts:

Clements A., *Principles of Computer Hardware*, Oxford (3rd Ed), 2000, ISBN: 0-19856453-8
Covers most of the module including a chapter on communications.

Tanenbaum A. S., *Computer Networks*, Prentice Hall (4th Ed), 2003, ISBN: 013-030852-8
Gives greater depth on the communications content but also goes beyond the needs of the course in many areas.

Other Text:

East I., *Computer Architecture and Organisation*, UCL Press, 1990, ISBN: 0273-030-38-8

Other Reading:

A good starting point for information on trends in computer architecture and innovative architectures can be found by visiting the websites of universities or colleges.

4 Computer networks

Rationale:

Virtually every computer is connected, or has the potential to be connected, to other computers. When connected locally, they provide vital services such as printing, file servers, CPU servers and electronic mail. When connected over a wide area they support the exchange of information in many forms. Millions of people world wide have been exposed to the World Wide Web of computers and the information they provide.

The explosion in the use of such intranets and the long established use of local area networks has made the study of computer networks and the underlying communication technology as important as the more traditional foundations of computer science such as computer architecture, operating systems and programming.

Aims:

- To develop an understanding of the modern network technologies in common use today
- To make informed decisions regarding the selection, purchase, installation and maintenance of local and wide area networks
- To identify potential and actual problems with existing networks and identify advances in technology that may solve them

Objectives:

- To understand the physical properties, performance characteristics and costs of communication media; specifically copper cable and fibre optics
- To understand the application of existing point to point data communication standards, including enhancements to those standards
- To appreciate the theory and practice of common local area networks
- To show how networks of different standards can be inter-connected
- To appreciate the significance of network and inter-network protocols; specifically the TCP/IP
- To understand the importance of network security and reliability, including examples of error recovery strategies and encryption systems

Prior Knowledge Expected:

Candidates are expected to be familiar with the material covered in the Certificate syllabuses and are expected to be familiar with computer architectures, particularly with regard to the representation of information within a computer system. Some practical exposure to local and wide area networks would be useful for context.

Content:

1 INTRODUCTION

Historical perspective, theoretical and practical models of network architecture particularly the ISO OSI and TCP/IP Models. Example networks and services including prototype new technologies. These would include X.25, Frame Relay, ISDN and ATM.

2 DIGITAL COMMUNICATION

Physical properties of copper media, fibre optics, radio communication, data communication standards. Maximum data rates (theoretical and practical) for different media including some simple analysis of signals. Data encoding of digital signals. The distinction between, and analysis of, physical media and wireless media properties. The difference between narrow band and broad band technologies with particular reference to ISDN and ATM.

3 LOCAL AREA NETWORKS

Types of LAN covering standards, topology and performance. Example architectures such as ethernet and fast ethernet, token ring, FDDI and ATMs. Wireless LANs and emerging technologies. Bridges and routing.

4 WIDE AREA NETWORKS

Circuit vs packet switching and associated routing and flow control. Detailed examples of existing and emerging architectures such as frame relay and ATM.

5 INTER NETWORKS

Principles of inter networking, architectures and protocols. Particular reference to TCP/IP.

6 ERRORS

The main causes of errors and the effect on transmission. Single bit and burst errors. Various error detection and correction strategies including parity, block sum, Hamming Codes and Cyclic Redundancy Checks. Forward vs backward error control. Statistical analysis of the effectiveness of error detection and correction code.

7 NETWORK SECURITY

Requirements of security and types of attack. Private vs public keys and electronic signatures. Practical examples including RSA, DES. Analysis of the effectiveness of algorithms and methods of attack.

Primary Texts:

Halsall Fred, *Data Communications, Computer Networks and Open Systems*, Addison Wesley (4th Ed), 1996, ISBN: 0-201422-93-X

Stallings William, *Data and Computer Communications*, Prentice Hall Int. (6th Ed), 2000, ISBN: 013-084370-9

Stallings William, *Network and Internetwork Security*, Prentice Hall Int. (3rd Ed), 2002, ISBN: 013-111502-2

Stallings William, *Local and Metropolitan Area Networks*, Prentice Hall Int. (6th Ed), 2000, ISBN: 013-012939-9

5 Database Systems

Rationale:

A database system is nowadays the central software of most data processing applications. A Database Management System supports the operation of database applications within an integrated, controlled and accessible framework.

Aim:

- To provide candidates with the necessary knowledge and skills to understand the principles and practice of database systems development.

Objectives:

- To introduce the theory of the relational model and relational programming languages
- To write data manipulation commands in SQL
- To write data definition commands in SQL
- To specify the functional and data requirements for a typical database application
- To produce detailed data models and their associated logical schemas
- To design the structure and functionality of a forms based user interface for a database application
- To be able to describe data distribution and data connectivity over a network

Prior Knowledge Expected:

Candidates are expected to be familiar with the material covered in the Certificate syllabuses.

Content:

1 AN INTRODUCTION TO THE FEATURES OF A RELATIONAL DATABASE PRODUCT

(e.g. ORACLE) including its data management and application development techniques (e.g. Forms generators and programming tools). Programming environments.

2 DATABASE MANAGEMENT SYSTEMS

Comparison of a data-centred approach with file-based approach.

Data integrity and quality control. Transaction processing. Logical and physical data independence how it is achieved.

3 DATA ANALYSIS AND DATA MODELLING

Entity relationship diagrams and conceptual modelling.

Relationship constraints and translation to relational model.

4 THE RELATIONAL MODEL AND RELATIONAL LANGUAGES

Functional Dependency theory and Normalisation. Relational modelling.

Simple relational algebra programs. Features of relational algebra in SQL.

5 SQL

Standards and basic structure of SQL for data definition, views, updates, insertion and referential integrity constraints.

- 6 DISTRIBUTED AND MULTI-USER DATABASE SYSTEMS
Concurrency, recovery and database integrity.
Client-server model as a distributed database architecture.

Primary Text:

Howe D. R., *Data Analysis for Database Design*,
Butterworth Heinemann (3rd Ed), 2001,
ISBN: 0-75065086-9

Other Texts:

McFadden J.A., & Hoffer F.R., *Modern Database
Management*, Benjamin Cummins (6th Ed), 2001,
ISBN: 0-13042355-6

Korth, Silberschatz, Sudarshan, *Database System Concepts*,
McGraw Hill (4th Ed), 2001, ISBN: 0-07-1217622

Watson, R.J., *Data Management*, (3rd Ed), Wiley, 2001,
ISBN: 0-471-41845-5

6 Object oriented Programming

(Version 2 - New)

For first examination in October 2003 and thereafter for two sittings a year. This represents a major change from the original syllabus.

Rationale:

Object Technology has been in development for over forty years. It is now embedded in such diverse area as requirements engineering, software architecture, analysis, design, programming, testing, deployment and maintenance. The most widely used modern programming languages C++, Java and VB.Net all embrace an object-oriented approach. This module examines the application of object oriented technology to programming. Candidates should have practical experience of at least one object oriented programming language.

Aims:

- To develop an understanding of the principles underpinning object-oriented programming
- To apply object-based approaches

Objectives:

- Explain the motivation for and development of object-oriented programming languages
- Produce a set of use cases given a problem statement
- Produce class diagrams, object interaction diagrams and object state transition diagrams for a given problem
- Describe the essential features of an object-oriented programming language
- Produce and/or debug code fragments that illustrate principles of object-oriented software development
- Describe the principles for testing object-oriented software and derive sets of test data given a specification

Prior Knowledge Expected:

Candidates are expected to be familiar with the material covered in the Certificate syllabuses, particularly Software Development. Candidates should have practical experience of at least one object-oriented programming language.

Content:

1 FOUNDATIONS

Genealogy of object oriented languages: structured programming, modular programming, abstract data types, encapsulation, typed and untyped languages, coupling and cohesion.

2 CONCEPTS

Objects and Classes. Object creation. Objects vs variables. Memory management, garbage collection. Class variables and instance variables. Object initialisation. Constructors and destructors. Methods and messages. Method signatures. Method and operator overloading.

Single and multiple inheritance. Subclasses and superclasses. Overriding. Invocation of superclass methods and constructors. The relationship between types and classes. Polymorphism. Abstract classes. Inheritance hierarchies. Software reuse.

Encapsulation: public, private and protected variables and methods.

Delegation. Collection classes.

3 DESIGN

Unified Modelling Language (UML). Use case diagrams: actors, system boundary, <<uses>> and <<extends>>. Scenarios. Class diagrams: associations, aggregation, dependency, and inheritance. Object interaction diagrams, object state transition diagrams. Object constraint language (OCL): invariants, preconditions, postconditions.

Design patterns. Pattern documentation: motivation, prerequisites, structure, participants and consequences. Examples of patterns: Adapter, Decorator, Iterator, Observer, Singleton.

4 PRACTICE

Iterative and incremental development styles.

Design of class hierarchies, refactoring.

Implementation of designs in an object-oriented programming language.

Testing object-oriented code. Class testing, constructing class tests from OCL or state transition diagrams, test driver construction. Testing interactions and class hierarchies.

Primary Texts: Analysis and Design

Budd T., *An Introduction to Object-oriented Programming*, Addison-Wesley (3rd Ed), 2001,
ISBN: 0-201-76031-2

Fowler M., *UML Distilled*, Addison-Wesley (2nd Ed), 1999, ISBN: 0-201-65783-X

McGregor J. D. and Sykes D. A., *A Practical Guide to Testing Object-oriented Software*, Addison-Wesley, 2001, ISBN: 0-201-32564-0

Shalloway A. and Trott J., *Design Patterns Explained: A New Perspective on Object-oriented Design*, Addison-Wesley, 2001, ISBN: 0-201-71594-5

7 Object oriented Programming

(to be discontinued after April 2005)

Rationale:

Object Technology has grown from a new programming paradigm to a complete solution development method encompassing requirements engineering, architecture, analysis, design, programming, testing, deployment, and maintenance. It not only covers software development but has found uses in other disciplines such as Business Process Re-engineering. People with object skills are in great demand. Object technology is forming the foundation of other technologies such as components and intelligent agents.

Aims:

- To understand the concepts and principles behind object-oriented development
- To understand the relationship with requirements engineering and architecture
- To develop understanding in the practice of designing and implementing small software systems
- To apply object-based approaches to software development
- To relate object-based methods to real-world situations

Objectives:

- Produce a set of use cases given a problem statement or textual requirements specification
- Derive an analysis object model and object interaction diagrams from a set of use cases
- Produce a design object model, object interaction diagrams and object state transition diagrams (as appropriate to the problem) from a set of use cases and analysis diagrams
- Produce code fragments which implement essential constructs of a design in an object oriented programming language
- Produce test cases which will verify that an implementation meets a requirements specification

Prior Knowledge Expected:

Candidates are expected to be familiar with the material covered in the Certificate syllabuses, particularly Information Systems.

Content:**1 FOUNDATIONS**

Genealogy of object oriented languages: structured programming, encapsulation

2 CONCEPTS

Objects and Classes

Inheritance: single and multiple inheritance, Polymorphism

3 PRINCIPLES

Responsibility driven design

Data and implementation hiding

Abstraction: generalisation behaviour to higher levels in a classification hierarchy, the importance of abstraction in reuse

4 PRACTICE

Methods: ability to use at least one major method: CRCs, UML or Shlaer-Mellor

Iterative and incremental development styles

Requirements Specification: identification of objects, use cases and scenarios

Architecture and Design: effects of object technology on architecture and design, identification and use of patterns

Implementation: implementation of a design in an object-oriented language such as Smalltalk, C++ or Java

Standards, persistence, team development environment

Testing: understand the implications and effects that object oriented programming has on testing

Primary Texts: Analysis and Design, Wirfs-Brock R., Designing Object Oriented Software, Prentice-Hall, 1990, ISBN: 0-13-629825-7

Fowler M. et al, UML Distilled, Addison-Wesley, 1999, ISBN: 0201-65783-X

Shlaer S. and Mellor S., Modelling the World in States Yourdon Press, 1991, ISBN: 0-13-629940-7

Primary Text: Programming, Siegel S., Object Oriented Software Testing, John Wiley & Sons, 1996, ISBN: 0-471137-49-9

Primary Text: Object Oriented Software Development OOTC et al, Developing Object Oriented Software, Prentice Hall/IBM, 1997, ISBN: 0-137372-48-5

Other Texts:

Gamma et al, Design Patterns, Addison-Wesley, 1994, ISBN: 0-201633-61-2

Klimas E. et al, Smalltalk with Style, Prentice Hall, 1994, ISBN: 0-131655-49-3

Lemay L. et al, Teach Yourself Java 1.1 in 21 days, Sams Publishing, 2000, ISBN: 0-67231898-9

Stroustrup B., The C++ Programming Language, Addison-Wesley, 1997, ISBN: 0-201889-54-4

Flanagan D., Java in a Nutshell, O'Reilly & Associates (4th Ed), 2002, ISBN: 0-596002831

Bruce Eckel, Thinking C++, Prentice Hall, 1995, ISBN: 0-139177-09-4

8 Project Management**Rationale:**

The project approach is more prevalent in industry today than ever before. It is therefore necessary for candidates to have an understanding of the methods and techniques used in Project Management early in their studies and careers.

Aims:

- To develop an awareness of the need for project planning and management.
- To apply professional attitudes and techniques to managing a project.

Objectives:

- To understand the stages in a project and its position in the systems development life-cycle.
- To develop an awareness of project planning and

estimating: structures and techniques.

- To display an awareness of the human factors necessary for team building and management; and professional conduct.
- To understand and develop a practical knowledge of progress monitoring, project control and reporting.

Prior Knowledge Expected:

Candidates are expected to be familiar with the material covered in the Certificate syllabuses.

Content:**1 STAGES IN A PROJECT**

Use of requirements elicitation, gathering, analysis.

Design of software, hardware and networks.

Build and/or OTS purchase.

Configuration and integration with current systems.

Installation issues, methods of going live.

Project closure and post-implementation activities.

Areas of risk in each stage.

Establishing a business case.

Establishing project objectives, goals and measures of success.

Risk Management.

2 PROJECT PLANNING AND ESTIMATING

Use of product and work breakdown structures WBS.

Use of (activity on node) precedence plans and network analysis.

Use of Gantt Charts.

Critical path analysis.

Estimating techniques including algorithmic models (e.g. COCOMO and function point approaches), expert judgement, analogy, top down and bottom up.

Risk identification and planning.

3 HUMAN FACTORS

Team building theory and practice, structures and responsibilities.

How to staff a project stage with appropriate skill sets; how and where to obtain skilled personnel.

Team management, motivation, retention.

Resource allocation.

Project organisation: roles of project boards (or steering committees), user and developer representatives, project managers, team leaders, suppliers, programme and project support, project assurance etc.

4 PROGRESS MONITORING, PROJECT CONTROL AND REPORTING

What to monitor and why.

Where and when to monitor.

Project control through monitoring.

Use of plans in project control.

Reasons for reports: whom to report to and how to report.

Types of report: exception, progress, management.

Monitor and control project finances and quality.

Implications and impact on the project.

Quality: control, assurance and management.

Primary Texts:

Field, Mike and Keller, Laurie, Project Management Open University, International Thomson Press, 1998, ISBN: 1861522746

Hughes, Bob and Cotterell, Mike, Software Project Management, McGraw-Hill (3rd Ed), 2002, ISBN: 007709834X

For our candidates in SE Asia, there is an Indian edition of this text (in English) as above. The publisher is Tate McGraw-Hill, New Delhi, ISBN: 007043854

Yeates D. & Cadle J., Project Management for Information Systems, Pitman (3rd Ed), 2001, ISBN: 0-273-65145-5

Other Reading:

International Journal of Project Management, Elsevier Science, ISBN: 0263-7863

9 Service Management

Rationale:

Services Management, and indeed management at all levels in the Information Technology industry, requires a specific set of competencies. The management competencies include skills required in general services management and more specific competencies associated with, and specific to, Information Systems and Technology. The Diploma syllabus is designed to develop an awareness of the variety of skills necessary to manage successfully in an Information Systems environment.

Aims:

- To examine the relationship between computer based information systems, management and organisations.
- To review concepts of management and organisation in the context of Information Technology.
- To describe traditional information support systems for managers.
- To understand the major issues concerning the management, development and operation of computer based information systems.

Objectives:

- Explain systems and management concepts and their relevance for information systems.
- Understand the importance and the need for professionalism in managing computer based systems.
- Explain the strategic use of information technology and the effect of advances in telecommunications and other equipment.
- Discuss the need for special types of MIS and describe their components.
- Describe the issues of planning the development of computer based applications.
- Understand the need for control and maintenance of information systems.
- Understand the importance of managing remote and network services.
- Examine the operational issues concerned with the management of information systems.

Prior Knowledge Expected:

Candidates are expected to be familiar with the material covered in the Certificate syllabuses.

Content:

- 1 INFORMATION SYSTEMS
 - Information systems components
 - Organisations and management
 - The information system as a sociotechnical system
 - The strategic use of Information Technology
- 2 MANAGEMENT INFORMATION SYSTEMS
 - Informational needs of organisations
 - Capabilities of information systems from an organisational perspective
 - Information requirements for management
 - Levels of planning and control with MIS
 - MIS support for business functions
 - Management reporting systems and transaction processing systems
- 3 SYSTEMS AND MANAGEMENT CONCEPTS
 - Systems approach, organisational design, MIS in organisational control e.g. feedback etc.
 - Management theory and management functions
 - Concepts of planning
 - Role of information systems in the planning process e.g. modelling and forecasting
 - Using MIS to enhance management control: performance reports, break-even analysis, calculation of financial ratios e.g. return on investment
- 4 MANAGERIAL DECISION MAKING
 - Decision-making
 - Components of decision support systems

Types of DSS

Building a DSS

Executive information systems

Organisational aspects of DSS and EIS

5 CULTURAL DIMENSION OF INFORMATION SYSTEMS DEVELOPMENT

Factors of organisational complexity in relation to information systems development

Human aspects of information systems

Contribution of system development approaches (such as Soft Systems Methodology and ETHICS)

Measures of performance to cover performance factors and service level agreements

Departmental and project budgets, including specific reference to training costs

6 PRINCIPLES OF PROFESSIONALISM

Professional concepts in relation to professional practices e.g. the BCS code of conduct. Business ethics.

7 ACQUISITION OF SOFTWARE, HARDWARE, MEDIA AND CONSUMABLES

Specification of hardware and software configurations and systems

Implications of throughput, resilience and reliability

Alternatives, costs and solutions

Selection criteria, acquisitions, purchase, hire or lease, facilities management

8 INSTALLATION AND SITE PLANNING, SECURITY AND EXTERNAL THREATS

Planning, scheduling and co-ordinating contractors, suppliers and services

Progress control and monitoring

Installation, test planning, acceptance criteria and trials

Implications of throughput, resilience and reliability

Workload

External threats and strategies to limit their effect

Security

9 APPLICATIONS AND SYSTEM REQUIREMENTS

Distributed, intelligent systems, electronic mail

Communication Networks

Intelligent office

Characteristics of telecommunication systems

Software production

Control of data

Operating system facilities

Primary Texts:

McNurlin & Sprague, *Information Systems Management in Practice*, Prentice Hall (5th Ed), 2001, ISBN: 0-13-042361-0

Fidler C. & Rogerson S., *Strategic Management Support Systems*, Financial Times Management, 1996, ISBN: 0-273-61418-5

Bernstein et al, *Internet Security for Business*, Wiley, 1996, ISBN: 0-471-13752-9

Other Reading:

Code of Practice for Information Security Management, British Standards Institute, 1995, BS7799, ISBN: 0-5802-3642-0

Carroll J.M., *Computer Security*, Butterworth-Heinemann, 1996, ISBN: 0-7506-9600-1

10 Software Development Environments (to be discontinued after April 2005)

Rationale:

This module is for those who wish to understand the engineering principles and skills necessary to specify, design, code, test, implement and maintain computer programs developed using procedural languages. A separate module exists for object oriented programming.

Aim:

- To understand the program development life cycle from requirements through to program maintenance.

Objectives:

- To demonstrate an ability to relate the technical aspects of program development to practical computer applications.
- To develop a comprehension of the importance of program documentation, quality assurance and program testing as part of software development.
- To understand the fundamentals of procedural programming design techniques.
- To gain knowledge of the principles of program specification, design, writing, testing and implementation.

Prior Knowledge Expected:

Candidates are expected to be familiar with the material covered in the Certificate syllabuses. Candidates are expected to have used a procedural programming language and to be familiar with the range of software development tools available.

Content:

- 1 THE SOFTWARE DEVELOPMENT LIFECYCLE
 - Requirements
 - Prototyping
 - Specification
 - Design
 - Coding
 - Implementation & Testing
 - Documentation
 - Maintenance
- 2 THE PROGRAMMING ENVIRONMENT
 - Editors
 - Source and object libraries
 - Compilers and interpreters
 - Command languages
 - Operating systems
- 3 PROGRAM DESIGN
 - Basic constructs (sequence, selection, iteration and modularity)
 - Design methods (functionality/data driven)
 - Charting design methods
 - Data analysis
 - Data structures
 - Type and organisation of files
- 4 PROGRAM DEVELOPMENT ENVIRONMENTS
 - Editing features
 - Debugging methods and tools
 - Libraries and modules
 - Compiler options
 - Macros and command files
- 5 PROGRAM TESTING
 - Structured testing methods
 - Development of a testing strategy
 - Testing tools
- 6 QUALITY ASSURANCE AND DOCUMENTATION
 - Programmer documentation
 - Use of standards
 - Quality factors such as reusability, portability, etc
 - Change control procedures

Primary Texts:

Bal H.E., *Programming Language Essentials*
Addison Wesley, 1994, ISBN: 0-20-163179-2

Bergin T.J., *A History of Programming Languages II*
Addison Wesley, 1996, ISBN: 0-20-189502-1

Cezzar R., *A Guide to Programming Languages*
Artech House, 1995, ISBN: 0-89-006812-7

Other Texts:

Appleby D., *Programming Languages: Paradigm and Practice*, McGraw Hill, 1997, ISBN: 0-07-005315-4 (out of print)

Sprankle M., *Problem Solving and Programming Concepts*, Prentice Hall, 2003, ISBN: 0-13-122807-2

11 Systems Analysis**Rationale:**

Systems Analysis is a central part of systems development. It comprises the process of turning a set of user requirements into a logical system specification and encompasses various activities to achieve this end. The traditional systems lifecycle has been challenged by alternative models, for example the spiral (iterative and incremental) lifecycle and rapid application development. There are a variety of systems development approaches including the structured approach, the object-oriented approach, soft systems methodology and agile or 'lightweight' approaches. Systems Analysis activities will be studied in the context of these trends. Candidates should be familiar with at least one structured approach (e.g. SSADM) and one object-oriented approach (e.g. the Unified Process).

Aims:

- To understand the role of systems analysis within various systems development life cycles.
- To develop an awareness of the different approaches that may be taken to systems analysis.
- To understand the systems analyst's activities, and apply current tools and techniques.

Objectives:

- Describe different life cycle models and explain the contribution of systems analysis within them.
- Discuss various systems analysis approaches and explain their strengths and weaknesses.
- Evaluate the tools and techniques that may be used by a systems analyst in a given context.
- Use appropriate methods and techniques to produce a systems analysis for a given scenario.
- Provide suitable systems documentation for an analysis.
- Discuss the CASE tools currently available to support the analyst.

Prior Knowledge Expected:

Candidates are expected to be familiar with the material covered in the Certificate syllabuses. It would be useful for candidates to study this module at the same time as the Diploma level syllabus Systems Design.

Content:

- 1 ANALYSIS OF EXISTING SYSTEMS AND NEW SYSTEMS
 - People
 - Organisational Analysis, concepts of systems and subsystems; Management structures - including matrix techniques; Socio-technological analysis
 - MIS concepts; Workflow considerations
 - Technology and Processes
 - Business process analysis; Information, data, and communications; Legacy systems; Network analysis, elementary queuing theory, distributed system/process analysis; Software quality analysis
 - System Life Cycles
 - Life cycle models - including alternatives, descriptions of stages; Impact of changes on different life-cycle models; deliverables at each stage
 - Object Oriented Programming Systems considerations.
- 2 REQUIREMENTS GATHERING AND SPECIFICATION
 - Feasibility studies; Requirements analysis; Data Analysis - reality/data/metadata; Project proposals; Requirements grading; User interface requirements.

- 3 THE STRENGTHS AND WEAKNESSES OF DIFFERENT APPROACHES
Hard methodologies: structured (e.g. SSADM); object-oriented (e.g. Unified Process).
Soft systems methodologies (e.g. Soft Systems Methodology).
Hybrid approaches (e.g. Multiview).
Rapid Application Development (e.g. DSDM).
- 4 ANALYSIS TECHNIQUES AND TOOLS
Structured techniques: data (e.g. entity-relationship diagram or logical data structure), process (e.g. data flow diagram) and time (e.g. entity life history) models
Object-oriented techniques: UML analysis models such as use cases, analysis class diagram.
Cross-checking models.
CASE tools and their contribution to systems analysis activities.
- 5 COMMUNICATION WITH USERS
Walkthrough approaches; Steering groups; User groups; Project boards; Conceptual design specification; Quality assurance techniques; Standards; Structured English description methods; Rich pictures.
- 6 SYSTEM DOCUMENTATION
The types of documentation likely to be required for effective logical systems specifications:
Organisation charts.
Discussion records.
Feasibility Study report.
Requirements Specification.

Primary Texts:

Avison D. & Fitzgerald G., *Information Systems Development: Methodologies, Techniques and Tools*, McGraw Hill (3rd Ed), ISBN: 0-07-709626-6
Bennett, S., McRobb, S. & Farmer, R. *Object-Oriented Systems Analysis and Design*, McGraw-Hill (2nd Ed), 2002, ISBN: 0-07-709864-1
Goodland M. with Slater C., *SSADM Version 4: A Practical Approach*, McGraw-Hill, ISBN: 0-07-709073-X

Other Texts:

Hawryszkiewicz, I., *Introduction to Systems Analysis and Design*, Prentice-Hall (5th Ed), 2001, ISBN: 1-7400-9280-5
Britton, C. & Doake, J., *Object-oriented Systems Development: a gentle Introduction*, McGraw-Hill, 2000, ISBN: 0-07-709544-8
Kendall, K. E. & Kendall, J. E., *Systems Analysis and Design*, Prentice-Hall, 2002, ISBN: 0-13-042365-3

12 Systems Design

Rationale:

Systems Design is a central part of systems development. It comprises the process of turning a set of user requirements into an implementable system and encompasses various activities to achieve this end. Alternative models are challenging the traditional systems development life cycle. Alongside this, two approaches to systems development are emerging: the traditional structured approach; and the object-oriented approach. The systems design activity will be studied in the context of these trends. Candidates should make themselves familiar with at least one traditional approach (e.g. SSADM) and one object-oriented approach (e.g. UML)

Aims:

- To understand the role of systems design within various systems development life cycles
- To develop awareness of the different approaches that may be taken to systems design
- To understand and apply the tools and techniques that are currently used by systems designers

Objectives:

- Describe different life cycle models and explain the contribution of systems design within them

- Discuss various systems development approaches and explain their strengths and weaknesses
- Evaluate the tools and techniques that may be used by a system designer in a given context
- Use appropriate methods to produce a system design for a given scenario
- Provide suitable systems documentation for a design
- Discuss the CASE tools currently available

Prior Knowledge Expected:

Candidates are expected to be familiar with the material covered in the Certificate syllabuses. It would be useful for candidates to study this module at the same time as the Diploma level syllabus Systems Analysis.

Content:

- 1 SYSTEMS DEVELOPMENT LIFE CYCLE MODELS
Traditional Waterfall Model
Alternative Models
Iterative; Spiral;
Rapid Application Development; Prototyping;
Joint Application Design; User Participation
- 2 SYSTEMS DEVELOPMENT APPROACHES
An overview of the following approaches and role of design within them:
Structured Systems Development
Object-oriented Analysis and Design
- 3 STRUCTURED SYSTEMS DESIGN (LOGICAL)
Logical Database Design
Entity-Relationship Modelling; Transforming the Entity Models to a
Relational Schema; Normalisation; Denormalisation; Views
Logical Process Design
Context Diagrams; Data Flow Diagrams; State Transition Diagrams;
Entity Life Histories; Decision Tables; Structured English
- 4 OBJECT ORIENTED DESIGN (LOGICAL)
Main Concepts
Objects; Classes; Messages; Methods; Inheritance; Encapsulation;
Static Modelling
Class Hierarchies (generalisation - specialisation relationships);
Containment hierarchies (whole-part relationships)
Dynamic Modelling
Messages: Services; Methods
- 5 PHYSICAL SYSTEMS DESIGN
Database Design
Record structures; File Organisations; Indexes; DBMS Platforms;
Physical Objects
Physical Process Design
Physical DFD; Modules; Structure Chart;
Transform analysis; Transaction analysis

Primary Texts:

Fowler, M with Scott, K., *UML Distilled*, Addison-Wesley, 2000, ISBN: 0-201-65783-X
Hoffer J.A., George J. F., Valacich J.S., *Modern Systems Analysis and Design*, Benjamin/Cummings, 2001, ISBN: 0-13042363-7

Other Texts:

Hawryszkiewicz I., *Introduction to Systems Analysis and Design*, Prentice-Hall, 2000, ISBN: 17-4009280-5
Skidmore, *Introducing Systems Design*, Macmillan, 1996, ISBN: 0-33-372140-3
Good for coverage of Object Oriented Design
Maciaszek, L., *Requirements Analysis and Systems Design: Developing Information Systems with UML*, Addison Wesley, 2001, ISBN: 0-201-70944-9

Lunn, K., *Software Development with UML*, Macmillan (Palgrave), 2003, ISBN: 0-333-98595-8

Good for Structured Systems Design

Whitten, J., Bentley, L. & Dittman, *Systems Analysis & Design Methods*, McGraw-Hill (5th Ed), 2003, ISBN: 007 118 0702

Other Reading:

Avison D., Fitzgerald G., *Information Systems Development: Methodologies, Techniques and Tools*, McGraw-Hill, 1995, ISBN: 0-07-709233-3

Booch G., Jacobson I., Rumbaugh J., *The Unified Modelling Language User Guide*, Addison-Wesley, 1998, ISBN: 0-20-157168-4

Goodland, M. with Slater, C., *SSADM Version 4: A Practical Approach*, McGraw-Hill, 1995, ISBN: 0-07-709073-X

13 The Internet and World Wide Web

Rationale:

The last decade has seen a revolution of global proportions. From the simple desire to network computers for academic use has come a phenomenon which is leaving few aspects of our daily lives untouched. This module examines the origins, technology and applications of the Internet and World Wide Web.

Aims:

- To develop an understanding of the Internet and World Wide Web
- To appreciate the range of application

Objectives:

- Describe the evolution of the Internet
- Understand what the Internet is and how it operates
- Discuss a variety of Internet and Web applications
- Select an appropriate Web development tool
- Identify the limitations of existing technology

Prior Knowledge Expected:

Candidates are expected to be familiar with the material covered in the Certificate syllabuses

Content:

- 1 THE INTERNET AND WWW
Evolution of the Internet and the Growth of the World-Wide Web (WWW)
Basic architecture of the Internet and Intranet/Extranet
Standards and protocols: HTTP, URLs, fixed and dynamic IP addressing
Methods of access: modem, ISDN, DSL/cable-modem, fixed LAN, wireless and mobile LAN, satellite LAN
- 2 INTERNET SERVICES AND APPLICATIONS
Email: email clients, server and gateways; SMTP, POP3 and IMAP
Remote login
File transfer – FTP file transfer Protocol
WWW – HTTP and HTTPS protocols, uses/abuses and applications
- 3 WEBSITE DEVELOPMENT
HTML & Scripting Languages: VBscript, JavaScript; static and dynamic HTML
Development tools: page and site authoring, delivery and maintenance tools
Multimedia Content: text, graphics, sound, animation and video
Design issues: visual, navigation content and user interface design approaches
- 4 RELATED ISSUES
Hosting: servers and clients; domains and DNS
Performance: speed, reliability, downtime, bandwidth, broadband Internet
Security: identification, authentication, access control, security attacks
Privacy: legal issues, individual rights, privilege, protection and abuse

Primary Texts:

Gralla P., *How the Internet Works*, Que Publishing (6th Ed), 2001, ISBN: 0-789-72582-7

Perry J. et al, *The Internet – Illustrated Introductory*, Course Technology (3rd Ed), ISBN: 0-619-1095-80

Other Texts:

Powell T., *Web Design: The Complete Reference*, Osborne McGraw-Hill; 2002, ISBN: 0072224428

Berners-Lee, T. et al, *Weaving the Web*, HarperBusiness, 2000, ISBN: 0-062-51587-X

McGoughlin, S., *Multimedia: Concepts and Practice*, Prentice Hall; 2001, ISBN 0-13-018830-1

Hofstetter, F.T., *Multimedia Literacy with CD Rom*, Irwin/McGraw Hill (3rd Ed), ISBN 0-07-238440-9

Other Reading:

Various on-line materials

PROFESSIONAL GRADUATE DIPLOMA

1 Advanced Database Management Systems

Rationale:

Database management systems are standard tools that enable the storage and retrieval of data within modern information systems. Units introducing database concepts are now an accepted part of most computer science courses. These introductory units tend to concentrate on the use of relational database systems. This advanced module, in contrast, deals with implementational aspects of relational systems and tests the candidates' knowledge of the current enhancements to relational database systems and object-oriented database systems.

Aims:

- Compare and contrast emerging architectures for database management systems
- Understand the manner in which relational systems are implemented and the implications of the techniques of implementation for database performance
- Appreciate the impact of emerging database standards on the facilities which future database management systems will provide

Objectives:

- Critically assess new developments in database technology
- Interpret and explain the impact of emerging database standards
- Evaluate the contribution of database theory to practical implementations of database management systems

Prior Knowledge Expected:

Candidates are expected to be familiar with the material covered in the Certificate syllabuses and the Diploma Database Systems syllabus.

Content:

- 1 THE RELATIONAL MODEL OF DATA
Theoretical concepts
Relational model conformity
- 2 RELATIONAL DATABASE MANAGEMENT SYSTEMS IMPLEMENTATION TECHNIQUES
Query optimisation
Concurrency control
Database performance tuning
Distributed relational systems
- 3 EMERGING DATABASE MANAGEMENT SYSTEM TECHNOLOGIES
Object-oriented, deductive, temporal and constraint database management systems
New database applications and environments: e.g. Data Warehousing; Multimedia; Mobility; Multidatabases; Interne

- 4 DATABASE AND RELATED STANDARDS
SQL standards, SQL-92 standard, SQL 3 standard
Object Data Management Group (ODMG) version 2.0 standard
Standards for interoperability and integration e.g. CORBA
- 4 DATABASE AND RELATED STANDARDS
SQL standards, SQL-92 standard, SQL 3 standard
Object Data Management Group (ODMG) version 2.0 standard
Standards for interoperability and integration e.g. CORBA

Primary Texts:

Date C. J., *An Introduction to Database Systems*, Addison-Wesley Longman (7th Ed), 2003, ISBN: 0-3211810-2

Eaglestone B. and Ridley M., *Object Databases*, McGraw-Hill, 1997, ISBN: 0-07-709354-2

Silberschatz A., Korth H. and Sudarshan S., *Database System Concepts*, McGraw-Hill (4th Ed), 2001, ISBN: 0-07-121 7622

Other Reading:

Date C. J. and Darwen H., *A Guide to the SQL Standard*, Addison-Wesley Longman, 1997, ISBN: 0-201-96426-0

2 Computer Services Management

Rationale:

Successful management of computer services requires a set of specific competencies in addition to a good general knowledge of Information Technology. These competencies include general service management competencies that may apply to many types of service provider and other competencies that are specific to IT services.

Aim:

- To use the knowledge that the candidate has demonstrated at Certificate level to explore in depth how these competencies can be used pro-actively to deliver excellent service to customers.

Objectives:

- To describe the purpose of a computer services organisation; and the essential relationships it must have with customers, including the fundamental concept of service.
- To describe options for the organisation of an appropriate computer services function for a particular organisational setting.
- To describe the main business processes that should be implemented for such a function to be effective, and the resources required to deliver them.
- To describe effective and professional approaches to procuring essential resources including staff, equipment, software and services necessary to deliver the main business processes.
- To explain why each aspect of the syllabus is important.
- To use their knowledge to address problem-solving in relevant situations.

Prior Knowledge Expected:

In addition to a good general knowledge of IT, candidates will be expected to be familiar with the Services Management syllabus at Diploma level so that, at Professional Graduate Diploma level, they can demonstrate an understanding of and an ability to apply the principles to justify their answers in a business context.

Candidates will require exposure to the practical application of the syllabus.

Content:

- 1 SERVICE CONCEPT
The concept of a service, understanding customer needs, determining customer satisfaction levels, relationship with customer businesses, achieving operational excellence, capability maturity model for software
- 2 ORGANISATION
A comparative overview of organisational groupings

necessary to define and manage services, deal with customers, plan and execute projects, and perform essential administration.

- 3 BUSINESS PROCESSES
The concept of business processes, specific business processes required, based on ITIL model or similar, includes primary functions such as service management; concept of end-to-end service; definition of service features and performance targets, planning, funding, resourcing.
- 4 CUSTOMER LIAISON
The customer-facing elements of the services organisation, Help-desk, Service Desk; fault logging and problem management, customer account management.
- 5 AVAILABILITY MANAGEMENT
Performance measurement; change management; configuration management; and version control; resource scheduling; library administration; asset management; shift and team organisation.
- 6 CAPACITY PLANNING
Monitoring of resource usage; determining technology strategy; developing investment plans; carrying out investment projects; security; business continuity planning and contingency planning; site planning.
- 7 SUPPORT PROCESSES
Financial, contracts, and personnel administration.
- 8 PLANNING, COSTING AND CHARGING
The requirement to cover costs with income; budget planning and control; need for and methods of charging of services to customers.
- 9 CONTRACTING AND PROCUREMENT
Procurement of hardware and software; service level agreement.
- 10 LEGAL AND PROFESSIONAL ISSUES
An awareness of current UK national and international legislation including Data Protection Act 1998, Computer Misuse Act 1990, equal opportunities; health and safety; current EU approaches to tendering; copyright and licensing issues; the BCS Code of Practice and its use in relation to Computer Services Management.

Primary Texts:

McNurlin & Sprague, *Information Systems Management in Practice*, Prentice Hall, 2001, ISBN: 013-042361-0

Other Reading:

Fidler C. & Rogerson S., *Strategic Management Support Systems*, Financial Times Management, 1996, ISBN: 0-273-61418-5

Bernstein et al, *Internet Security for Business*, Wiley, 1996, ISBN: 0-471-13752-9

Code of Practice for Information Security Management, British Standards Institute, 1995, BS7799, ISBN: 0-5802-3642-0

Carroll J. M., *Computer Security*, 1996, Butterworth-Heinemann, ISBN: 0-7506-9600-1

Central Computer & Telecommunications Agency (CCTA), IT Infrastructure Library, *The Business Perspective on your IT Infrastructure: Understanding and Improving*, 1996, HMSO, ISBN: 0-11-330679-2

This book contains some good examples of "best practice" and is used by many suppliers, including major companies outside the UK. This is only intended to be consulted for reference in a library.

3 Distributed and Parallel Systems

Rationale:

The programmer has available a range of distributed and parallel systems. Choosing a relevant one and then using it appropriately is a complex matter. The aim of this module is to provide the candidate with an overview of the available hardware and software, along with a detailed understanding of how to use such systems and an understanding of their shortcomings.

Aims:

- To understand the strengths and requirements of distributed and parallel systems
- To develop an ability to develop and implement appropriate algorithms

Objectives:

- Compare and contrast a range of distributed and parallel systems
- Discuss hardware and software issues of such systems
- Critically evaluate the suitability of a system for a particular use
- Design and implement algorithms for distributed and parallel systems
- Describe the historical development of distributed and parallel systems
- Demonstrate a knowledge of current distributed and parallel systems

Prior Knowledge Expected:

Candidates are expected to be familiar with the material covered in the Certificate syllabuses, and in the Diploma syllabus Computer Networks.

Content:**Architectures:**

The architectures of distributed and parallel systems are diverse and the following, at least, should be considered: Multiprocessors, Multicomputers, Multithreading, Pipelining, VLIWs, Superscaling, Vectors, SIMDs, Systolic architectures, Internetworking.

Programming Models:

A variety of models exist, supported by a range of language and environments. The following issues should be considered: Actions, Threads, Processes, Concurrency, shared Objects, Distributed Objects, Remote Invocation, Mutual Exclusion, Client/Server, Peer-to-Peer, Semaphores, Monitors, Message Passing, Co-ordination, Agreement, Safety, Liveness.

Performance:

Performance is often considered to be literally how fast a job runs, other issues need also to be considered, including: Service Support, Resource Management, Availability, Reliability, Security, Fault Tolerance, Recovery, Protection, Scaling.

Primary Texts:

Pfister G F, *In Search of Clusters*, Prentice Hall (2nd Ed), 1998, ISBN: 0-13-899709-8

A provocative book covering issues of parallel and distributed computing. Hardware and software issues are presented.

Coulouris G., Dollimore, J., and Kindberg T., *Distributed Systems*, Addison-Wesley (3rd Ed), 2001, ISBN: 0201-61918-0

A best selling text on open distributed systems. Covering foundations, including networking and communications. Important issues are also addressed in depth, including security and integrity.

Magee J. and Kramer J., *Concurrency*, John Wiley, 1999, ISBN: 0-471-98710-7

The book provides a systematic treatment of the concepts and issues in concurrency, a rigorous technique to specify and model concurrent behaviour and a wide range of examples to illustrate the concepts and issues in concurrent programming. The book can be viewed on-line at www.dse.doc.ic.ac.uk/concurrency

Other Texts:

Crichlow J., *The Essence of Distributed Systems*, Prentice-Hall, 2000, ISBN: 0130-15167-X
Offers a mainly top-down approach to the key issues pertinent to the design and construction of a distributed system.

Emmerich W., *Engineering Distributed Objects*, John Wiley and Sons, 2000, ISBN: 0-471-98657-7
Covers concepts, middleware for distributed objects, and common design problems. Also available in e-book form.

Quinn M., *Parallel Computing*, McGraw-Hill, 1994, ISBN: 0-07-113800-5

This text includes coverage of the several successful parallel computers, including the Connection Machine's CM-S and Intel's Paragon XP/S.

Siwa D., Fountain T. and Kacsuk P., *Advanced Computer Architectures*, Addison-Wesley, 1998, ISBN: 0-201-42291-3
Explores the design space of architectural classes and related concepts.

Other Reading:

There are a number of journal articles that are relevant to this syllabus and the student should be familiar with contemporary work. A good starting point for a literature search would be the *Computer Journal* Vol. 40 No 8, 1997, which was a special issue on Building Parallel and Distributed Systems. There are many web sites incorporating information on distributed and parallel systems. It is recommended that a suitable search is undertaken as part of the study of this module.

Computer Journal, ISSN: 0010 4620, (OUP on behalf of the BCS) or http://www.oup.co.uk/computer_journal (on-line subscription) or a good reference library.

4 Knowledge based Systems

Rationale:

This module is designed to provide an overview of the Artificial Intelligence (AI) field with particular emphasis on knowledge representation. It will be of particular interest to candidates whose work requires them to build intelligent systems although no previous AI experience is expected. As well as covering the various mechanisms and systems used to represent knowledge, methodologies for knowledge engineering will be studied. The module also covers the emerging area of Adaptive Computing which includes the use of artificial neural networks and genetic algorithms.

Aims:

- Gain a thorough knowledge of the field of Artificial Intelligence and its applications
- Understand the emerging approaches in AI and their implications for information engineering
- Appreciate the different systems available for representing knowledge

Objectives:

- Discuss the typical approaches used in AI problem solving
- Apply a variety of knowledge representation systems to a given problem
- Compare and contrast various knowledge representation systems
- Discuss methodological approaches to developing knowledge based systems
- Explain concepts used in adaptive computing and describe their application to problem solving
- Describe the major AI application areas and techniques used within them

Prior Knowledge Expected:

Candidates are expected to be familiar with the material covered in the Certificate syllabuses.

Content:

- 1 OVERVIEW OF THE ARTIFICIAL INTELLIGENCE FIELD
 - Basic concepts
 - Definition of AI; Background and past achievements; Aims
 - Overview of application areas
 - Problems and problem solving
 - State space search; Production rules; Logic
 - Heuristic search techniques
 - Generate and test; Hill climbing; Search reduction strategies
- 2 KNOWLEDGE REPRESENTATION
 - Representation models
 - Predicate logic; rules; Semantic nets; Frames;
 - Conceptual graphs;
 - Scripts
 - Fuzziness and uncertainty
 - Fuzzy logic; Statistical techniques for determining probability

Methodologies for developing knowledge based systems

The KBS Development Life Cycle; Knowledge acquisition

Prototyping; Implementation; Development environments

3 ADAPTIVE APPROACHES

In both of the following approaches, learning and applications will be emphasised

Neural networks

Architectures; Hopfield network; Multi-layer perception Feedforward; Backpropagation

Genetic algorithms

Basic concepts; Population; Chromosomes; Operators;

Schemata; Coding

Rule induction

Basic concepts; Decision trees/rule sets

4 MAJOR APPLICATION AREAS

Expert systems

Natural language processing

Machine vision and robotics

Data mining and intelligent business support

Primary Text:

Rich E., Knight K., *Artificial Intelligence*, McGraw-Hill, 1993, ISBN: 0-07-100894-2

Other Texts:

Goldberg D. E., *Genetic Algorithms in Search, Optimisation and Machine Learning*, Addison-Wesley, 1989, ISBN: 0-20-115767-5

Michalski, Bratko, Kubat, *Machine Learning and Data Mining*, Wiley (3rd Ed), 1999, ISBN: 0-471-97199-5
This publication is not only about Knowledge based Systems but also about data mining.

Peter Jackson, *Introduction to Expert Systems*, Addison-Wesley (3rd Ed), 1998, ISBN: 0-201-87686-8

Partridge D. Hussein K., *Knowledge-based information Systems*, Wiley, 1994, ISBN: 0-07-707624-9

5 Management Information Systems

Rationale:

This module is designed for those candidates who are, or will be, in a position to make or influence decisions related to the selection, design and support of management information systems (MIS).

Aims:

- To understand MIS in both the wider managerial context and in the narrower confines of the selection, support, design and development of computer applications.
- To focus on the concepts a manager needs to understand in order to make effective use of computerised information systems.

Objectives:

- A knowledge of MIS, and the application of telecommunication, office automation, decision support and executive information systems.
- The application of MIS knowledge to the selection and design of systems appropriate to a management requirement.
- An awareness of how MIS may make a contribution to the strategic management of an organisation both now and in the future.

Prior Knowledge Expected:

Candidates are expected to be familiar with the material covered in the Certificate syllabuses and the Diploma syllabuses Systems Analysis and Systems Design, although completion of such modules is not mandatory.

Content:

1 MANAGEMENT IN ORGANISATIONS

Role of the management function within an organisation
The evolution of the MIS function in an organisation
Strategic management and MIS
Using MIS as a tool for changing the ways of business
MIS and the Value Chain
Managing MIS projects
Outsourcing considerations

2 MIS SUPPORT CAPABILITIES

The migration to distributed systems and client/server technologies
The applicability of packages versus bespoke applications
The management and control of information resources at the corporate level
Principles and application of trends in support such as BPR, DIP, data warehousing and DTP
Office automation products, their use and interface with other systems
Use of data modelling and data mining facilities

3 DEVELOPMENT OF MIS

The growth of MIS
The traditional MIS development life cycle and contemporary development methodologies
Use of CASE, RAD and Object Oriented methodologies
Matching development methodologies with application requests
End-user computing, applications and implications
Re-engineering legacy systems

4 FUTURE TRENDS

Trends in hardware, software, communications
Impact of the communications revolution
Virtual organisations
Teleworking
The continued evolution of Internet applications

Primary Texts:

McNurlin and Sprague, *Information Systems Management in Practice*, Prentice Hall (5th Ed), 2001, ISBN: 0-13-042361-0
or

Fidler C., and Rogerson S., *Strategic Management Support Systems*, Financial Times Management, 1996, ISBN: 0-273-61418-5

6 Network Information Systems

Rationale:

Network information systems have in many ways become the public face of the profession. In most developed and developing cultures, the NIS use is almost ubiquitous, for functions as diverse as medical treatment scheduling and road traffic management.

Aim:

- To gain an understanding of how to propose, develop, manage and review all aspects of Network Information/ systems – in terms of both strategic and operational requirements

Objectives:

- Assist in planning the development of a new networked information system in a technical environment with which they are familiar
- Advise, within the limits of their knowledge and experience, on the suitability of particular information systems and network architectures for specific environments and applications
- Give appropriate advice regarding HCI issues in relation to network information systems, with reference to other appropriate professional specialisms
- Provide examples of both good and bad practice in networked information systems development – and justify their views by detailed analysis

- Demonstrate knowledge of legal and moral issues relating to networked information systems. This should include the needs of security, integrity, availability, subject privacy, licensing, copyright and access management

Prior Knowledge Expected:

Candidates are expected to be familiar with the material covered in the Certificate syllabuses and at least one of the Networks, Systems Analysis or Systems Design syllabuses.

Content:

- HISTORICAL CONTEXT OF NETWORK INFORMATION SYSTEMS INCLUDING:**
Development of Arpanet/Internet.
The progression of NIS from mainframes to mini- and desktop-centred systems.
- ADVANTAGES AND DISADVANTAGES OF DISTRIBUTED PROCESSING SYSTEMS**
Distributed processing systems - distributed applications and distributed data, client/server architecture.
- SECURITY, DATA INTEGRITY AND AVAILABILITY OF NIS**
Including backup, user access, control, encryption, security certificates, digital signatures, electronic payment systems, BS7799.
- OPERATIONAL NETWORK/NIS MANAGEMENT ISSUES**
Traffic modelling and congestion control - examples of tools/protocols for network management - response and other performance issues.
- HUMAN COMPUTER INTERACTION**
Requirements for good and bad interface design
Human factors.
- LOCAL AND WIDE AREA NETWORKS**
Compare and contrast the strategic and operational issues, together with an awareness of intellectual property, copyright and licensing issues.
Should include discussion of the particular needs of Intranet, Internet NIS development.
- LOCAL AREA NETWORKS**
Compare currently available architectures, performance issues, scalability, bridging vs routing, cabling infrastructure, hubs, traffic management.
- WIDE AREA NETWORKS**
Compare different WAN structures - packet switching - circuit switching – development of SMDS/ATM.
- MESSAGING AND INFORMATION SERVICES**
Electronic mail, Web site development and management, EDI in the context of the Internet.

Primary Texts:

The range of titles available in this field is very wide, and it is important to note that the books listed here are only examples. These titles have been chosen because they:

- Cover one or more areas of the syllabus.
- Are currently available in the UK.
- Have been published or revised recently.

Bernstein T., Bhimani A. B., Schulz E. and Siegal C. A., *Internet Security for Business*, John Wiley & Sons, 1996, ISBN: 0-471-13752-9

Chaffey D., *Groupware, Workflow and Intranets: Reengineering the Enterprise with Collaborative Software*, Digital Press, 1998, ISBN: 1-55558-184-6

Collins T. & Bicknell D., *Crash: Ten Easy Ways to avoid a Computer Disaster*, Simon and Schuster, 2000, ISBN: 0-684-868350

Coulouris G., Dollimore, J., and Kindberg T., *Distributed Systems*, Addison-Wesley (3rd Ed), 2001, ISBN: 0-201-61918-0

Robson W., *Strategic Management & Information Systems*, Pitman (2nd Ed), 1997, ISBN: 0-273-61591-2

Stalling W. & Van Slyke R., *Business Data Communications*, Prentice Hall (4th Ed), 2000, ISBN: 0-13-090350-7

Other Reading

Secure Computing, ISSN: 1352-4097

7 Programming Paradigms

Rationale:

Much software has been developed in procedural programming languages which make use of similar control constructs and which differ only in the application area with which the software is associated. The modern programmer, however, may choose from a wide selection of languages, each of which offers a new perspective on the task of software construction. This module aims to provide the candidate with an overview of modern programming languages and the programming paradigms they implement.

Aims:

- To explore a range of modern programming languages and programming techniques
- To appreciate the contribution language designers can make to software engineering practice
- To select appropriate software development tools for given application environments

Objectives:

- To be able to compare and contrast a range of programming paradigms
- To evaluate programming language features critically with respect to the way they support good software engineering practice
- To discuss the appropriateness of the use of a given programming paradigm within a given environment

Prior Knowledge Expected:

Candidates are expected to be familiar with the material covered in the Certificate syllabuses and in two of the Diploma syllabuses, Software Development Environments and Object Oriented Programming.

Content:

- THE NATURE OF PROGRAMMING LANGUAGES**
Imperative languages v non-imperative languages
Scripting languages
Data-oriented languages
Object-oriented languages
Event-driven programming
Language standardisation
- PROGRAMMING ENVIRONMENTS**
Compilers
Interpreters
Interactive development tools
Run-time support environments
Debugging tools
Testing tools
Configuration management
- OBJECT ORIENTATION**
Basic concepts: objects, classes, methods, overloading methods, messages inheritance: overriding methods, single inheritance, multiple inheritance Interfaces (e.g. in Java), encapsulation, polymorphism
- FUNCTIONAL PROGRAMMING**
Definition of a function: domain and range, total and partial functions, strict functions
Recursion
Referential transparency
Side effects of functions
- LOGIC PROGRAMMING**
Basic constructs
Facts: queries, existential queries, conjunctive queries, rules
Definition of a logic program
Semantics of a logic program

Recursive programming: Computational model of logic programs, unification
Goal reduction
Negation in logic programming

6 RELATED ISSUES

Visual programming
Concurrency
Distribution

Primary Texts:

Any one of the following three texts will provide adequate coverage of most of the syllabus, although they do not cover concurrency and distribution, and the coverage of scripting languages and event-driven programming is very limited.

Clark R. G., *Comparative Programming Languages*, Addison-Wesley (3rd Ed), 2000, ISBN: 0-201-71012-9

Sebesta, R. W., *Concepts of Programming Languages*, Addison-Wesley (5th Edition), 2001, ISBN: 0-201-75295-6 (A 6th edition is due to be published in 2004)

Tucker A. and Noonan R, *Programming Languages: Principles and Paradigms*, McGraw Hill, 2001, ISBN: 007112280X

Other Texts:

Scripting languages and event-driven programming are covered by:

Barron D. W., *The World of Scripting Languages*, Wiley, 2000, ISBN: 0-471-99886-9

The following book covers concurrency and distribution (in much greater detail than is required for this module).

Bacon J., *Concurrent Systems: An Integrated Approach to Operating Systems, Database, and Distributed Systems*, Addison-Wesley, 1997, ISBN: 0-201-17767-6

8 Safety Critical and Real Time Software

(to be discontinued after April 2005)

Rationale:

There are many software systems which are embedded in safety critical systems (e.g. railway signalling systems and aircraft flight control systems). Such systems tend to be 'real time' in that a useful response is required from the system within a specified length of time of the occurrence of an event. This will give rise to two quite different requirements: a system which will behave predictably and correctly and a system which will handle asynchronous events.

Aim:

- To gain an insight into the design principles behind such systems and the design compromises required to implement a practical system.

Objectives:

- Develop a detailed knowledge of the software life cycle as it applies to safety-critical systems
- Understand the concept of software quality and how it can be measured
- Develop knowledge of formal methods and the validation process
- Develop an understanding of asynchronous (real time) systems and the basic asynchronous abstractions
- Develop knowledge of the practical problems associated with real time systems and mechanisms employed to minimise such problems

Prior Knowledge Expected:

Candidates are expected to be familiar with the software life cycle, the principles of operating systems and modern programming languages, at the level at which these are covered in the relevant Diploma syllabuses.

Content:

1 SAFETY AND HAZARD ANALYSIS

Use of software in safety related systems
Legal and ethical considerations
Hazard analysis – analytical techniques: FMEA,

HAZOP, FTA, ETA

Risk assessment – frequency and consequences of hazardous events

Safety integrity levels and safety cases

2 SOFTWARE RELIABILITY

Distinction between safety and reliability of systems

Achievement of software reliability by fault prevention and fault tolerance

Software reliability requirements specification, modelling, prediction and assessment

3 DEVELOPMENT PROCESS

Fault prevention in terms of fault avoidance and fault removal

Software and safety life cycles

Choice of methodology – formal vs non-formal methods

Requirements Engineering

Software design – including HCI

Coding – choice of programming language, safe subsets

4 FORMAL METHODS

Algebraic, model and process based specification languages

Degree of rigour

Refinement proofs, verification proofs and animation

5 SOFTWARE VV&T

Test management and the test process

Static and dynamic analysis

Reviews and inspections

Test phases – module, integration, system and acceptance

Techniques and measures – black and white box selection

CAST and simulation

6 FAULT TOLERANCE

Redundancy and common mode failures

N-version programming and recovery blocks

7 STANDARDS

Safety

Quality

Certification and safety cases

8 REAL-TIME BASICS

Flynn's classification of systems – SISD, SIMD, MIMD

Shared memory multiprocessor systems and networked multiprocessor systems

The concepts of a process, a task and a thread

Polling and contention

Resources, events and synchronisation – "test and wait"

9 REAL TIME MODELS

Process states, process scheduling and process control

Real time scheduling: deadline, worktime and slacktime

Semaphores, co-routines and monitors

Interprocess communication with and without shared memory

10 REAL TIME IMPLEMENTATION ISSUES

Access control to shared resources, critical regions

Deadlock, deadlock detection and avoidance, the banker's algorithm

Producer consumer problems, the sleeping barber problem, the dining philosopher's problem

Implementation language issues, Occam and Linda

Atomic operations, idempotent operations

11 REAL TIME APPLICATIONS

Crash resistance, persistent memory and recovery strategies

Distributed DBMS issues: ACID (atomicity, consistency, isolation and durability), time stamp ordering, two phase locking, commit and abort.

Primary texts:

Storey N., *Safety-Critical Computer Systems*, Addison-Wesley Longman, 1996, ISBN: 0-201-42787-7

Cooling J.E., *Software Design for Real-Time Systems*, Chapman and Hall, 1991, ISBN: 0-412-63240-3 (out of print)

Bacon J., *Concurrent Systems*, Addison-Wesley, Longman, 1992, ISBN: 0-201-41677-8

9 Software Engineering

Rationale:

In order to develop high quality software it is imperative that Information Systems Professionals have an understanding of software development as an engineering discipline. This understanding should be focused on both the practical and theoretical aspects of the discipline.

Aims:

To gain a knowledge of:

- The principles of software engineering
- Software process models and process improvement
- Development methods
- Requirements and specification
- Software design
- Software implementation
- Verification and validation
- Software project management
- Software quality

Objectives:

- An understanding of a wide variety of software engineering principles, process models and development methods
- A knowledge of the different phases in software engineering; requirements, specification, design, implementation, verification and validation
- Project management capability
- A knowledge of how to produce high-quality software
- An awareness of the special requirements for specific types of system such as safety critical systems
- An understanding of the practical problems in developing software systems

Prior Knowledge Expected:

Candidates are expected to be familiar with the material covered in the Certificate syllabuses, should have knowledge of at least one structured programming language and understand the principles of software design and implementation.

Content:

1 PRINCIPLES OF SOFTWARE ENGINEERING

Candidates must be aware of the fundamental principles underlying Software Engineering and understand why an 'engineering discipline' is required to develop high quality software systems.

Engineering vs Programming

Programming in the Large vs Programming in the Small

High Quality Software Systems vs Software Programs

2 PROCESS MODELS

Candidates should be aware that there are many process models that can be used as the basis for a software development life-cycle:

- Overview of Process Models and their importance
- V-model
- V-model with prototyping
- Evolutionary Development
- Incremental Development
- Spiral Model
- Cleanroom Process Model
- DSDM (a process model not a method)
- Comparison of Models

3 DEVELOPMENT METHODS AND TECHNIQUES

Candidates should show a theoretical and practical understanding of the following:

Structured Methods and Techniques (e.g. SSADM)

DataFlow Diagrams

Entity-Relationship Diagrams

State Transition Diagrams

Statecharts

Object Oriented Methods and Techniques (e.g. UML)

Use Cases

Class Diagrams

Behaviour Diagrams (e.g. collaboration diagram)

Implementation Diagrams (e.g. component diagram)

Formal Methods

VDM, Z, B

CSP, Mascot, Petri-Nets

4 SOFTWARE DEVELOPMENT LIFE CYCLE

Candidates should show a practical understanding of developing software products through a development life-cycle:

Requirements

Requirements Analysis and Capture

Requirements Engineering, e.g. CORE

Requirements Tracking

Functional Requirements

Non-Functional Requirements

Specification

Refinement of Requirements

Natural Language Specification

Diagrammatic

Formal, Mathematical Specification

Use of Abstraction

Rapid Prototyping

Design

Refinement of Specifications

System Architectures

Different Design Approaches

Design Trade-Offs (e.g. modular vs performance)

Performance Modelling/ Simulation

Structured Design vs O-O Design

Implementation

Encapsulation and Modularisation

Information Hiding (ADTs/ Interfaces)

Coupling and Cohesion

Component Reuse

Debugging

Performance Measurement

Validation and Verification

Testing; black-box and white box, statistical

Formal Proof

Correctness Arguments

Inspections and Reviews

Static and Dynamic Analysis Tools

Using the Compiler

Maintenance

5 PROJECT MANAGEMENT

Risk Management

Team Management (Personnel and Technical)

Project Planning (Resource and Technical)

Education and Training

Cost Estimation

Project Scheduling

6 SOFTWARE QUALITY

Software Quality Assurance

Configuration Management and Change Control

Software Tools

The 'ilities'

Standards

Documentation

Metrics

Primary Texts:

Sommerville I., *Software Engineering*

Addison-Wesley (6th Ed), 2000, ISBN: 0-201-39815-X

One of many books that give an overview of Software Engineering.

Ould M.A., *Strategies for Software Engineering: The Management of Risk & Quality*, Wiley, 1999, ISBN: 0-471-99782X

An excellent book on development of Software Development Processes through the management of risk and quality. Provides a good introduction to different software development processes.

Ould M.A., *Managing Software Quality & Business Risk*, Wiley, 1999, ISBN: 0-471-99782X

Meyer B., *Object-Oriented Software Construction*, Prentice Hall International (UK) Ltd, 1997, ISBN: 0-13-629155-4

A good introduction to Object-Oriented principles with a view to developing software. Also introduces Eiffel.

Other Texts:

As indicated, some of the books mentioned here are out of print. They are included because they are still relevant and useful and can be found in many libraries.

Jones C., *Systematic Software Development using VDM*, Prentice Hall, 1990, ISBN: 0-13-880733-7 (out of print)

A great introduction to formal specification using the Vienna Development Method. Look out for the deliberate mistake in the first few pages. Best to ignore the sections on proof the first time you read it.

Gilb T., *Principles of Software Engineering Management*, Addison-Wesley, 1988, ISBN: 0-201-19246-2

A classic text on software engineering management that provides a good description of evolutionary software development.

Duncan et.al, *SSADM in Practice: A Version 4 Text*, MacMillan Press Ltd, 1995, ISBN: 0-333-46999-2

A good text on the use of SSADM (out of print).

Fowler M., *UML Distilled*

Addison-Wesley, 1999, ISBN: 0-201-65783-X

A good overview of the Unified Modelling Language for those with a knowledge of object-oriented analysis and design.

Wordsworth J.B., *Software Development with Z: A Practical Approach to Formal Methods in Software Engineering*, Addison-Wesley, 1992, ISBN: 0-201-62757-4 (out of print)

A good introduction to the specification language Z.

Other Reading:

Booch G., *Object-Oriented Analysis and Design with Applications*, Benjamin/Cummings Publishing Company, 1994, ISBN: 0-8053-5340-2

An alternative introduction to O-O principles.

Boehm B., *Software Engineering Economics*, Prentice Hall, 1981, ISBN: 0-13-822122-7

A classic text on the economics behind software engineering.

10 System Design Methods

Rationale:

System design methods constitute the framework that enables the building of information systems to be treated as a disciplined engineering activity rather than as a craft. The range of methods available varies from very informal sets of guidelines to highly formal and mathematical approaches. While claims that some method is universally applicable are often made, all methods are, in practice, applicable only to certain classes of application.

All information systems engineers should be familiar with at least one system design method. This option is intended for the large numbers of candidates who need to go beyond a simple familiarity with the method used in their own organisation because they have to:

- choose a method appropriate for a new class of application,
- monitor the implementation of a new method,
- create a method appropriate to a special set of circumstances.

Aim:

- To develop a wide understanding of system design methods, together with a critical practitioner's knowledge of at least one such method and a general familiarity with a number of others, not restricted to a single application area

Objectives:

- Identify the weaknesses and limitations of proposed design methods
- Develop expertise in selecting a system design method (or combination of methods) appropriate to a given environment, identifying and taking into account all relevant factors
- Be able to assist in planning and managing the introduction of a system design method into an existing development environment
- Be able to assist in planning and implementing monitoring procedures to evaluate the effectiveness of a method in practice
- Identify areas in which changes to the method might usefully be introduced

Prior Knowledge Expected:

Candidates are expected to be familiar with the material covered in the Certificate syllabuses. Candidates should have practical experience of using at least one system design method on a real life project. An elementary knowledge of statistics and discrete mathematics is also required.

Content:

1 BASIC ELEMENTS OF SYSTEM DESIGN METHODS

Waterfall, V-model, spiral model, prototyping.

The relationship between activities and life cycle phases; deliverables associated with each phase.

The relationship between life cycle models and system design methods.

Graphical notations including inter-alia data flow diagrams, entity life history diagram, entity relationship diagrams, state transition diagrams and state charts.

Formal notations based on mathematical logic and algebra.

Techniques for validation and verification: reviews, inspections, walkthroughs, etc; automatic techniques.

2 CONSTRUCTION OF A METHOD

The idea of the virtual machine underlying a design method and the way in which this affects the applicability of the method. Examples of methods illustrating the use of the techniques and notations listed in section 1.

3 SELECTING A METHOD

Technical factors: matching the method to the type of application; suitability of the method for use with existing software development environment; life cycle coverage; interfacing with other methods; tool support.

Non-technical factors: how widely used is the method; documentation and training; availability of staff; how is the method supported; standardisation; track record.

4 INTRODUCING A METHOD

Piloting and evaluating the pilot. Motivating staff who will be using the method. Role of consultants. Education and training. Reverse engineering of existing systems to fit in with the new method. Pitfalls.

5 EVALUATION AND TUNING

Statistical process control as applied to the software development process. Appropriate software metrics: strengths and the dangers inherent in their use.

Use of metrics to improve the software development process.

The relationship between structured methods and software quality assurance.

Assessing the benefits obtained through the introduction of a new method.

Primary Texts:

Most system design methods consist of a life cycle model together with a set of techniques and notations, supported by a set of software tools. There is a wide range of books on software engineering that cover these topics among others, although they give little detail about specific methods. The following are examples of such books, either of which can be recommended for this option; there are, however, many others:

Avison D. Fitzgerald G., *Information Systems Development: Methodologies, Techniques & Tools*, McGraw-Hill (3rd Ed), 2002, ISBN: 0077096266

Sommerville I., *Software Engineering*, Addison Wesley (6th Ed), 2000, ISBN: 0-201-39815-X

Pressman R.S., *Software Engineering: A Practitioner's Approach*, McGraw Hill (5th Ed) (European adaptation), 2001, ISBN: 0-07-21181822

Humphrey W.S., *Managing the Software Process* Addison Wesley, 1990, ISBN: 0-201-18095-2

This book is particularly valuable for its explanation of how statistical process control can be used to improve system design methods.

Other Reading:

Budgen D., *Software Design Methods*, Addison-Wesley (3rd Ed), 2003, ISBN: 0-201-722194

Jackson M., *Problems, Methods and Specialisation* Software Engineering Journal, Vol. 9, No 6., 1994

This article explores the nature and limitations of design methods in greater depth than the texts cited above.

Kitchenham B.A., Linkman S.G. and Law, D.T. *Critical Review of Quantitative Assessment* Software Engineering Journal, Vol. 9, No 2., 1994

Kitchenham B.A., Pickard L. and Pfleeger S.L., *Case Studies for Method and Tool Evaluation*, IEEE Software, July, 1995

These articles describe techniques that have been used for carrying out quantitative assessments of the benefits of system design methods.

11 User Interface Design**Rationale:**

The proliferation of textbooks attempting to explain the operation of reputedly user-friendly software packages is one indicator of the need for effective user-interface design. Another, and more important, indicator is the problem of poor interface design in safety critical systems. Effective and efficient user interface design is thus of crucial importance in all aspects of information and control systems.

Aims:

- To identify design issues
- To undertake measurement of interfaces
- To develop good design principles

Objectives:

- Identify issues in HCI and UID
- Understand the requirements of good UID
- Apply appropriate engineering-based principles to UID

Prior Knowledge expected:

Candidates are expected to be familiar with the material covered in the Certificate syllabuses and the Diploma syllabuses Systems Analysis and Systems Design.

Content:**1 ELEMENTS OF GRAPHICAL AND OTHER COMMUNICATION**

Menus, windows, WIMP systems. Object-oriented systems, OLE principles. Hypertext/hypermedia principles. Principles of interactive operation. Font and symbol design. Principles of screen contrast and display backgrounds. Principles of screen and hard-copy resolution. Graphic file formats. Help/support facilities. Screen painting principles

2 PARADIGMS OF USER INTERFACES

Cognitive and perceptual abilities, recognition versus recall. Principles of dialogue design. Ergonomics of user interfaces. Syntactic/semantic models of user behaviour. Learnability/flexibility/robustness. System objectives, e.g. end-user application or development system. Analogue versus digital representations.

Analytical, expert, observational, survey, and experimental evaluation methods.

3 REQUIREMENTS OF USERS

Ergonomic workplace/workstation design.

Learnability/flexibility/robustness.

4 USE OF COMPUTER-BASED SYSTEMS IN COMMUNICATION

Response, usability. Icon systems. Keyboard and other user input/response methods. Hyper media interfaces. Interactive interface design. Screen form/form design systems.

5 METRICS FOR USE IN UID

Usability specifications. Measurement criteria.

Task description analysis. Task monitoring.

Cognitive task analysis.

6 APPLICATION OF ENGINEERING PRINCIPLES TO DESIGN AND PRESENTATION

Usability engineering. Menu structuring. Logical/physical design translation. User walkthrough. User Interface Management Systems(UIMS).

7 MAJOR APPLICATION AREAS

Typical application areas: end-user computing interfaces, end-user interfaces (non-computing), control & instrumentation system interfaces.

Primary Texts:

Hill S., *A Practical Introduction to the Human-Computer Interface*, Continuum International Publishing Group, 1995, ISBN: 1-85805-119-3

Shneiderman B., *Designing the User Interface-Strategies for Effective Human-Computer Interaction*, Addison-Wesley (3rd Ed), 1998, ISBN: 0-201-69497-2

Preece J., (Ed), *Human-Computer Interaction*, Addison-Wesley, 1994, ISBN: 0-201-62769-8

Preece J. (Ed), *A Guide to Usability*, Addison-Wesley, 1993, ISBN: 0-201-62768-X

12 World Wide Web – Beyond the Basics**Rationale:**

This module is a progression route from the Diploma module *The Internet and World Wide Web*. Developing some of the issues introduced in the Diploma module, it takes a more strategic view of the World Wide Web and its applications.

Aims:

- To develop a strategic overview of the World Wide Web and its applications
- To evaluate the opportunities and limitations offered by the World Wide Web

Objectives:

- Identify web design issues
- Apply appropriate techniques to web site development
- Appreciate current and emerging web technologies and standards
- Differentiate between the security hazards presented by the Web
- Specify a security solution
- Appreciate the privacy issues
- Understand strategic uses of the web

Prior Knowledge expected:

Candidates are expected to be familiar with the material covered in the Certificate syllabuses and the Diploma module *The Internet and World Wide Web*.

Content:

1 WEBSITE DESIGN

Basic design principles: navigation and interface design, software engineering

Web design standards: web engineering and information systems standards

Internationalisation: addressing, content considerations, language and fonts;

Formatting and layout: tags, fonts, styles, style-sheets; separation of style and content

Multimedia content: standards for graphics, sound, animations, video; video-streaming

Dynamic HTML: accessing the DOM (documenting object model) using scripting languages (e.g. VBScript and JavaScript)

2 WEB TECHNOLOGIES AND STANDARDS

Web technologies: object technologies, object-oriented systems, information systems

Emerging Web standards: systems, technologies and design integration, HTML standards; XHTML; XML standards, XSL, XSLT, Xpath, Xlink; web services; SVG

Information Systems Interface (e.g. ASP, ColdFusion, PHP etc., ASP.Net)

Accessibility standards (W3C WAI etc., BCS guidelines etc.)

Legal and Ethical issues

3 SECURITY AND PRIVACY

Vulnerabilities, threats and attack methods

Cryptography: random numbers, hashes, ciphers, keys (public and private)

Authentication: passwords, credentials, passports, digital signatures, privileges; system, network and Internet based authentication

Network security: securing sockets, remote procedures and services; protection against denial of service attacks and server hijacking,

Risk assessment: threats, vulnerabilities, attacks and motives; the STRIDE threat model; ranking, responding and mitigating threats

Security policies

4 STRATEGIC USES OF THE WEB

E-commerce: business-to-business, business-to-consumer, consumer-to-consumer

Education: teaching and learning, learning environments, research

Entertainment: games and edutainment; leisure and life-style

Primary Texts:

Niederst, J., *Web Design in a Nutshell*, O'Reilly & Associates (2nd Ed), 2001, ISBN: 0-596-00196-7

Schneier, B., *Secrets and Lies, Digital Security in a Networked World*, (with CD Rom) John Wiley & Sons Inc, 2000, ISBN: 0-471-25311-1

Other Texts:

Howard, M. and Leblanc, D., *Writing Secure Code*, (with CD Rom), Microsoft Press, 2001, ISBN: 0-7356-1722-8

Mitchell, S. *Designing Active Server Pages*, O'Reilly & Associates, 2000, ISBN: 0-596-00044-8

Walther, S et al, *Sams Teach Yourself E-commerce Programming with ASP in 21 Days*, Sams, 2000 ISBN: 0-672-31898-9

Other Reading:

NOTES

NOTES

BCS SERVICES

For more information on any of the BCS services shown below, please visit the appropriate web address.

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The Certificate in IT for Insurance Professionals is the only qualification designed specifically to cover IT issues and responsibilities in the insurance industry. Developed jointly by the Chartered Insurance Institute (CII) and the British Computer Society (BCS), it provides evidence of a broad understanding of the principles and use of IT in insurance, independent of any particular software or hardware platform.

www.bcs.org/exam/citip

- **INFORMATION SYSTEMS EXAMINATIONS BOARD (ISEB)**

ISEB qualifications add value to professional careers by providing both the means and the platform for recognition and enhanced career development. Qualification areas cover Management, Development, Quality and Service Management.

www.iseb.org.uk

- **EUROPEAN COMPUTER DRIVING LICENCE® (EDCL)**

EDCL is the internationally recognised computer skills qualification which enables people to demonstrate their competence on computer skills. EDCL is managed in the UK by the BCS.

www.ecdl.co.uk

- **ECDL ADVANCED**

ECDL Advanced has been introduced to take computer skills certification to the next level and teaches extensive knowledge of particular computing tools.

www.ecdl.co.uk

- **INFORMATION SYSTEMS QUALITY AT WORK (ISQW)**

The ISQW recognises best practice in employee IT training and development. ISQW is about making the most of the people in your IT organisation. It has been specifically designed to encourage, support and acknowledge IT practitioners with industry recognised career development procedures and processes.

www.bcs.org/isqw

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