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## Information Technology In The Accounting Curriculum

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## **Preface**

Information Technology (IT) is pervasive in the world of business. Competence with this technology is an imperative for the professional accountant.

This Guideline has been developed by the Education Committee to provide further guidance to member bodies in developing programs to enhance the competence in IT of their present and future members. It is in a format which both recognizes the different competencies needed for key roles undertaken in the IT area by the professional accountant and distinguishes between pre- and postqualification needs. The guideline defines the broad content areas and specific knowledge and skills required by all professional accountants in connection with IT applied in a business context.

Because many of the education requirements involve practical skills, they would be best met through a combination of formal education and practical application of skills in a professional work environment.

For the formal education component, the coverage of some of the topics identified in this Guideline could be provided through courses specifically designed to develop IT knowledge and skills or spread over and integrated into courses which are not specifically identified as IT courses. For example, coverage of some aspects of computer-based business systems could be integrated within a financial accounting course; coverage of some aspects of management information systems could be integrated within a management accounting course; coverage of some aspects of internal control in a computer environment could be integrated within an auditing course; and so on.

For the formal IT education, case studies, interactions with experienced professionals, and similar techniques should be used to enhance the presentation of subject matter and to help students develop practical skills.

Some member bodies may wish to offer their own distance education courses, or to supplement courses at post-secondary institutions with their own training programs or employer-provided training programs. This might be necessary where there are not sufficient resources at post-secondary institutions to offer some parts of the required program of studies or to supplement theoretical knowledge obtained at post-secondary institutions with practical experience.

On-the-job training can provide valuable practical exposure to these topics. Member bodies must ensure that prequalification education and experience requirements are designed to provide aspiring professional accountants with opportunities to obtain both theoretical knowledge and practical skills in connection with the topics identified in this guideline.

The Committee recognizes that member bodies will be adopting different approaches to education in the IT area in the light of their own particular circumstances. Already some will have made much progress, others less so. Recognizing that further developments in IT will not wait on the profession, the Committee advises each member body to review the Guideline promptly and consider how it can best address its recommendations.

The Committee is conscious of the diverse circumstances and resources of member bodies and the significant development costs involved in the implementation of programs of education in IT. It would remind users that this is an area wherein there is significant potential for co-operation between member bodies and consequently avoidance of duplication of development costs.

The IT scene is one of constant change and development. It is the intention of the Committee to review this Guideline every two years in the light of emerging changes in information technology and its uses. In the meantime, it will welcome comment and suggestions from users of the Guideline.

## **Introduction**

1. Information technology plays a vital role in supporting the activities of profit-oriented and not-for-profit organizations. Professional accountants, in addition to extensively using various types of information technologies, often play important managerial, advisory, and evaluative roles in connection with the adoption and use of various information technologies by organizations of all types and sizes.
2. The term “information technology” or IT, as used in this Guideline, encompasses hardware and software products, information system operations and management processes, and the skills required to apply those products and processes to the task of information production and information system development, management and control.
3. Society expects that professional accountants who accept an engagement or occupation have the required level of knowledge and can apply it to practical problems. The accountancy profession as a whole has the obligation to ensure that candidates for membership possess the required breadth and depth of knowledge and skill and the credibility of the accountancy profession depends on its success in fulfilling this obligation. In addition, the accountancy profession has an obligation to ensure that, after qualifying, members keep abreast of relevant developments through continuing professional education.
4. The body of knowledge and skill required of professional accountants includes a variety of important areas. IT is one of the core competencies of professional accountants and requires special attention due to its explosive growth and its rapid rate of change.
5. The following IT trends are particularly noteworthy:
  - wide availability of powerful yet inexpensive computer hardware, including the widespread incorporation, through miniaturization, of powerful computing capabilities in numerous devices designed for personal and professional use;
  - wide availability of powerful, inexpensive and relatively user-friendly software with graphical user interfaces;
  - shift from custom-tailored systems to pre-packaged software;
  - shift from mainframes to small computers used alone, or increasingly, as part of networks devoted to information sharing and co-operative computing with corresponding changes in the nature, organization and location of key information system activity, such as the shift to end user computing;
  - increasing availability of computerized data for access in real or delayed time both locally and through remote access facilities, including via the Internet;
  - new data capture and mass storage technologies leading to increasing computerization of data/information in text, graphic, audio and video

formats and emphasis on managing, presenting and communicating information using multi-media approaches;

- convergence of information and communication technologies, affecting how people work and shop;
  - increasing use of networks to link individuals, intra-organizational units and inter-organizational units through systems such as electronic mail (e-mail) and the Internet, including the World Wide Web;
  - increasing use of the Internet for conducting commerce between organizations and individuals and between organizations and other organizations through electronic commerce systems such as electronic data interchange (EDI) and electronic funds transfer systems (EFTS);
  - mass marketing and distribution of IT products and services such as computers, pre-packaged software, on-line data retrieval services, electronic mail, and financial services;
  - reduction of barriers to systems use, encouraging wider penetration of information systems into profit-oriented and not-for-profit organizations of all sizes for accounting and broader management and strategic purposes and increasing the role of end-user computing;
  - wider penetration of information technologies such as computer-assisted design and computer-assisted manufacturing (CAD/CAM), computer imaging systems, executive information systems (EIS), and electronic meeting systems (EMS);
  - new system development techniques based around information technologies such as computer-assisted software engineering (CASE), object-oriented programming, and workflow technologies;
  - continuing development of intelligent support systems incorporating expert systems, neural networks, intelligent agents, and other problem solving aids; and
  - new business re-engineering approaches based on effective integration of information technologies and business processes.
6. The growth and change that has come about as a result of these trends has created a number of important challenges which the accountancy profession must address:
- **Information technologies are affecting the way in which organizations are structured, managed and operated.** In some cases the changes are dramatic. While there is a continuing need for sound business system design practices and effective financial and management controls, the business planning and design processes and internal control requirements will, of necessity, change with changes in information technologies. Traditionally, professional accountants have been entrusted with the tasks of evaluating investments in business systems, evaluating business system designs and reporting on potential weaknesses. Increasingly, information technology deployments are supported by extensive organizational restructuring around such technologies. To maintain the accountancy

profession's credibility and capability in supporting new information technology initiatives, the competence of professional accountants must be maintained and enhanced so that public trust and confidence in professional accountancy bodies is maintained.

- **Information technologies are changing the nature and economics of accounting activity.** The career plans of professional accountants and related training systems must be based on a realistic view of the changing nature of accounting, the accountancy profession's changing role in providing services to business, government and the community at large, and the knowledge and skills required for future success as a professional accountant. Some IT skills, such as the ability to use an electronic spreadsheet, are now indispensable and professional accounting bodies must ensure that candidates possess core IT skills before they qualify as members of those bodies. In addition, since an increasing number of professional accountants are engaged in providing IT-related advisory and evaluative services, it is important that professional accountancy bodies maintain the quality and credibility of these services through both prequalification and postqualification education requirements.
  - **Information technologies are changing the competitive environment in which professional accountants participate.** Information technologies are eliminating some areas of practice which were once the exclusive domain of professional accountants or are reducing their economic attractiveness. For example:
    - Accounting and accounting system development were once the virtually exclusive domain of professional accountants. Today, inexpensive, easy-to-use and powerful pre-packaged accounting software is reducing the demand for those activities or enabling non-accountants to offer those services. At the same time there is an increasing demand for professionals with a combination of business and IT skills to help organizations structure their systems to provide effective and efficient support for their primary objectives and activities.
    - Tax planning and tax return preparation have traditionally represented important activities for many professional accountants. Today, inexpensive, easy-to-use and powerful pre-packaged software is reducing the demand for tax return preparation services. The professional tax planning expertise that was once the private domain of individual practitioners is increasingly being embedded within these same tax packages, reducing the demand for such services as well.
    - In the past, accountants engaged in internal and external auditing activities were needed in great numbers in order to vouch and trace documents, to perform a variety of analyses, and to document audit work. Today, due to the computerization of business records and the availability of computer-assisted auditing tools, these activities can be performed faster and more thoroughly with the assistance of computer-based tools, reducing the demand for such activities.
7. IT changes have created many new opportunities for professional accountants in areas such as information development and information system design,

information system management and control, and information system evaluation. For example:

- **information development and information system design:** professional accountants have a tradition of producing information to enhance management decision-making. With the advent of new information technologies and expanded sources and means of access to information, professional accountants can help bring richer sets of information to bear on specific managerial decisions or help screen out essential information from the potentially overwhelming proliferation of information that is now available. One of the implications of the growth of such services is the need to expand professional accountants' perspectives beyond their traditional focus on accounting information to other important types of information and performance indicators, including non-financial information.

Information systems are increasingly viewed as a potential means to achieve competitive advantage. Professional accountants, by virtue of their broad business backgrounds, financial skills and objectivity, can provide valuable advisory services related to assessing investments in strategic information technologies and advising about control systems required to meet the needs of management and, in some cases, the requirements of legislators and regulators.

Multiple objectives exist within most information systems installations. They will invariably lead to cost vs. quality vs. control trade-offs; i.e., information systems personnel may resist implementing additional controls if they perceive them to detract from the ease-of-use or efficiency of a system, since these criteria may be important in their performance evaluations. Professional accountants can provide a valuable advisory service by bridging communications gaps, adding a sound business perspective to the consideration of IT control issues and vice versa.

- **information system management and control:** Information system management skills are not primarily technological, but rather, include an understanding of strategic and operational business planning and associated IT issues, the ability to perform appropriate analyses of IT investments, an understanding of IT related benefits and risks, the ability to stimulate and manage organizational change, and the ability to communicate effectively about IT topics.
- Information system management has been characterized by a communication gap between top management or functional managers lacking IT skills and technologists lacking in business backgrounds. Professional accountants can provide a valuable service by bridging such communications gaps, adding a sound business perspective to the consideration of IT issues and vice versa.
- **information system evaluation:** professional accountants have traditionally provided evaluative services in their roles as internal and external auditors. As information technologies proliferate, there are increasing demands for objective assessments of information system controls such as controls over information privacy and integrity, and

controls over system changes. In addition, there are concerns about information system failure and the reliability of information processing continuity provisions in the event of system failure. Other areas of concern are the proliferation of incompatible subsystems and inefficient use of systems resources.

8. All of the areas identified above represent important work domains in which significant numbers of professional accountants participate. Some of these areas are not the exclusive domain of professional accountants and are not commonly associated with the accountancy profession. However, they all represent important opportunities for professional accountants.
9. Professional and academic accountancy bodies throughout the world are grappling with the need to define the body of knowledge and skill that must be possessed by their members. Attempts at defining a common body of knowledge and skill are complicated by several important factors which must be recognized, including the fact that the accountancy profession is a diverse profession whose members operate in several domains, that within each of these domains professional accountants may be engaged in a variety of roles, and that the spread of IT and related accounting services is not uniform throughout the world.
10. Nevertheless, it is evident that IT is fundamentally changing professional accounting whatever the accountant's work domain or role. Consequently, professional accountancy bodies throughout the world must address these changes through their educational processes, by including coverage of important IT concepts and skills in prequalification education programs, prequalification work experience, and postqualification professional education in both general work domains and specialty areas.

## **SCOPE OF THE GUIDELINE**

### **Work Domains**

11. The accountancy profession is a diverse profession whose members operate in several work domains, such as:
  - industry and commerce
  - public practice
  - public sector (government and other not-for-profit organizations)
12. This Guideline is intended to apply to all work domains. The use of an organizing framework built around roles, as discussed in the next section, provides a framework that is sufficiently broad to address the needs of all three of the work domains identified above.

### **Roles**

13. Within each of the work domains, professional accountants may be engaged in a variety of roles, such as:

- user
  - financial manager (accountant, controller)
  - designer of financial information systems (member of business system design team or task force, producer of financial information, analyst)
  - internal financial or operational auditor
  - external “advisor” (accountant, auditor, tax practitioner, consultant, insolvency practitioner)
14. In different environments, specific needs and opportunities will vary; however, many aspects of IT are common and it is possible and desirable to set out some of the broad elements of an educational background that all professional accountants can be legitimately expected to share.
  15. This Guideline establishes a framework for organizing IT-oriented education for professional accountants, and the core areas of knowledge and skill to be covered. This Guideline identifies the IT education requirements for professional accountants under five main headings:
    - general IT education requirements
    - the accountant as *user* of information technology
    - the accountant as *manager* of information systems
    - the accountant as *designer* of business systems (alone or as part of a team)
    - the accountant as *evaluator* of information systems
  16. While the four broad roles of user, manager, designer and evaluator are not as specific as the areas in which many professional accountants actually work, they represent the key elements of knowledge and skill required by professional accountants and provide a useful framework by which an educational approach can be organized.
  17. The education requirements may be viewed as building blocks in the sense that the general IT education requirements form the foundation for the user-oriented education requirements and these, in turn, form a foundation for the other role-related education requirements. In addition, the education requirements related to the roles of user, manager, designer and evaluator may be viewed as building blocks for one another, in the sense that the accountant’s design role may be enhanced by the skills developed as a user, the accountant’s managerial role may be enhanced by the skills and insights obtained through a combination of user and design roles, and the accountant’s role as evaluator can be enhanced by skills developed in the user, designer, and manager roles. Thus, an aspiring management accountant would be guided by the portions of the Guideline dealing with the general IT education requirements, user-oriented education requirements and education requirements related to the manager role. An aspiring public accountant would be guided by the portions of the Guideline dealing with the general IT education requirements, user-oriented education requirements and education requirements related to the evaluator role.
  18. It is acknowledged that a professional accountant may operate in more than

one of these roles during a given time period and throughout his or her career. However, this Guideline does not presume that all professional accountants will work through these roles in a sequential fashion.

### **Prequalification and postqualification**

19. This Guideline distinguishes between the prequalification and postqualification IT related education requirements. The Guideline assumes that at the time of qualification, all professional accountants will operate in at least two roles - the user role and one of the other three roles, depending on the member's work domain. After qualification, professional accountants' careers and their IT education requirements may evolve in many diverse ways. Thus, the postqualification IT education requirements are not based on the same assumptions as the prequalification requirements and have a separate section of the Guideline devoted to them.
20. Member bodies should monitor prequalification experience to ensure that it includes IT-related training opportunities in the knowledge and skill areas related to their members' activities.
21. After qualification professional accountants are expected to continue their professional education activities in connection with IT. It is likely that some members' specific activities and related educational requirements will be relatively specialized. The continuing professional education requirements in connection with IT for both specialist and non-specialist accountants at the postqualification stage must be relevant to their current field(s) of activity.
22. IFAC recommends that member bodies work towards developing continuing professional education (CPE) requirements related to IT for their members' postqualification work domains to ensure that a minimum level of service quality is maintained.
23. Member bodies may wish to recognize the qualifications of members who have achieved specialist status in a recognized domain of IT activity by granting them specialist designations or other appropriate recognition.

### **Knowledge and Skill**

24. The field of IT is both conceptual and concrete. In considering IT education requirements it is easy to blur the distinction between conceptual knowledge and practical skills. However, it is important to emphasize the need for both relevant theoretical knowledge of IT and practical IT skills on the part of the professional accountant.
25. Practical experience consists of knowledge and skills acquired from participation in activities performed by professional accountants. It is distinct from the theoretical knowledge obtained from studies of a conceptual nature.
26. Conceptual education generally aims at knowledge and comprehension of specified subject matter. Practical skills include the abilities to apply conceptual knowledge, analyze, synthesize and evaluate information. An education approach that consists solely of conceptual material will not be sufficient for professional accountants in any work domain or for any role.

However, it is also generally recognized that the development of practical skills is facilitated by the prior development of knowledge and comprehension. Thus conceptual material must form the foundation for practical skills development.

27. This Guideline simplifies several stages of skills development into two main categories - theoretical knowledge and practical skills. Member bodies may wish to refine the classification used here into more specific knowledge and skill requirements corresponding to more specific education objectives.
28. The inculcation of skills in solving practical problems through the application of theoretical knowledge is one of the prime objectives of professional education. This ability is best developed through relevant practical experience in which conceptual knowledge can be applied to specific problems. To ensure that professional accountants possess entry level competence in core IT knowledge and skill areas, all prospective members must receive training and work experience sufficient to develop core IT knowledge and skills prior to qualifying for membership in their respective member bodies. Member bodies must monitor candidates' prequalification experience to ensure that it includes such training opportunities.
29. Core IT knowledge and skill requirements may be viewed from the perspectives of both breadth and depth. In this Guideline, the breadth requirements are addressed by using work domains as a way of categorizing knowledge and skill areas.
30. The depth requirements are addressed by distinguishing two levels of depth — a prequalification level, requiring only general familiarity with topics, and a postqualification level, requiring mastery of those topics. Requirements pertaining to depth of knowledge and skill are further addressed by dividing the education requirements into three building blocks aimed at providing increasing depth of coverage of core IT knowledge and skill sets:
  - a set of general IT education requirements;
  - a set of user-oriented education requirements; and
  - a set of role-related education requirements associated with the manager, designer, and evaluator roles.
31. During the prequalification program there will be comparatively more emphasis on fundamental conceptual knowledge and comparatively less emphasis on practical skills, whereas in the postqualification curriculum there will be comparatively greater emphasis on practical skills tied to the specific needs of the work domain and role of the professional accountant, and comparatively less emphasis on conceptual knowledge. Nevertheless, to be effective, both prequalification and postqualification parts of the professional accountant's education program must incorporate both knowledge and practical skills development.

### **Prequalification Tests of Professional Competence**

32. Prequalification tests of professional competence must include coverage of IT concepts and skills appropriate to the primary roles in which accountants

striving for qualification in a given membership body will be expected to function at an entry level.

33. Tests of professional competence in connection with IT must go beyond testing knowledge and comprehension and focus primarily on testing higher level skills such as application, analysis, synthesis and evaluation, applied in a context representative of the work domain in which the entry level professional accountant is likely to work.

#### **Postqualification Tests of Professional Competence**

34. Postqualification tests of competence in a specialty area must include coverage of IT concepts and skills appropriate to the area.
35. At the postqualification stage, tests of professional competence must be relatively specialized. Their main purpose is to validate that a professional accountant possesses specialist level skills in a particular domain.

### **PREQUALIFICATION IT KNOWLEDGE AND SKILL REQUIREMENTS**

#### **Introduction**

36. This part of the Guideline addresses each of the four roles identified earlier and identifies broad IT knowledge and skill requirements for professional accountants. This broad statement of requirements is supplemented by more detailed Appendices to this Guideline breaking down the knowledge and skill requirements into detailed topics.
37. During the prequalification stage, all professional accountants must obtain the general IT knowledge and skills summarized in paragraphs 40-49 dealing with General Information Technology Education Requirements.
38. In addition, all professional accountants must obtain the knowledge and skills summarized in paragraphs 50-62 and Appendix 3 to this Guideline dealing with The Professional Accountant as a User of Information Technology.
39. Furthermore, as part of their prequalification education, all professional accountants are expected to concentrate on at least one of the three other roles identified in this Guideline and acquire the knowledge and skills identified for the role(s) in which they are expected to function at an entry level. These roles are discussed as follows:

- Manager of information systems — paragraphs 63-71 and Appendix 4 to this Guideline
- Designer of business systems — paragraphs 72-84 and Appendix 5 to this Guideline
- Evaluator of information systems — paragraphs 85-97 and Appendix 6 to this Guideline

### **General Information Technology Education Requirements**

40. All professional accountants, irrespective of their primary work domain or role, must acquire the following essential body of IT knowledge related to business systems:
- information technology concepts for business systems (Appendix 1 to this Guideline)
    - general systems concepts
    - management use of information
    - hardware
    - system software
    - application software
    - data organization and access methods
    - networks and electronic data transfer
    - transaction processing in typical business and accounting applications
  - internal control in computer-based business systems (Appendix 2 to this Guideline)
    - control objectives
    - control framework
    - control environment
    - risk assessment
    - control activities
    - monitoring of control compliance
  - management of IT adoption, implementation, and use (Appendix 4 to this Guideline)
    - strategic considerations in IT development
    - administrative issues
    - financial control over IT
    - operational issues
    - security, backup and recovery
    - management of system acquisition, development and implementation
    - management of system maintenance and change
    - management of end-user computing
  - development standards and practices for business systems (Appendix 5 to this Guideline)

- role of information in organization design and behavior
  - system design techniques
  - system acquisition/development life cycle phases, tasks, and practices and maintaining control over system development processes
  - evaluation of computer-based business systems (Appendix 6 to this Guideline)
    - legal, ethical, auditing and information system control standards
    - evaluation objectives
    - evaluation methods and techniques
    - communicating results of evaluations
    - following up
    - specific types of evaluations
    - computer-assisted audit techniques (CAATs)
41. Prior to qualification, all professional accountants must have at least a general level of knowledge of each of the content areas identified in paragraph 40.
  42. Of particular importance to all professional accountants, regardless of their specific domain of professional activity, is the issue of internal control. Because this topic is of central importance to all professional accountants, it must be given particular emphasis.
  43. Professional accountants must have effective practical skills as well as theoretical knowledge. Case studies, interactions with experienced professionals, and similar techniques can be used to help develop practical skills. On-the-job training could also provide valuable practical exposure to these topics. Member bodies must ensure that prequalification education and on-the-job training are designed to provide aspiring professional accountants with opportunities to obtain both theoretical knowledge and practical skills in connection with the topics identified in paragraph 40.
  44. Appendices 1 and 2 to this Guideline provide a further breakdown of the specific topics that make up the general IT education to be acquired by all professional accountants prior to qualification. It is acknowledged that specific topics may change over time as IT evolves; however, the broad knowledge and skill areas identified in the Appendices represent the topics widely regarded as the minimum coverage required in an IT curriculum for accounting professionals.
  45. It is anticipated that coverage of the knowledge and skill areas identified in paragraph 40 at a general introductory level will require, at a minimum, the equivalent of two post-secondary level courses, although the coverage may be spread over and integrated into a number of courses.
  46. As contemplated in this Guideline, a post-secondary course is considered to consist of approximately 40 hours of in-class instruction, as well as an additional 80 hours spent on preparation for class, doing homework assignments, and engaging in other relevant study activities.
  47. The amount of time devoted to the knowledge and skill areas identified in this Guideline and the level of material presented should be equivalent to those which would be provided through formal courses at a university. However, it

is not necessary for the specified education to be provided through separate IT-oriented courses or exclusively in a university setting.

48. The coverage of some of the topics identified in this Guideline could be spread over and integrated into courses which are not specifically identified as IT courses. For example, coverage of some aspects of computer-based business systems could be integrated within a financial accounting course; coverage of some aspects of management information systems could be integrated within a management accounting course; coverage of some aspects of internal control in a computer environment could be integrated within an auditing course; and so on.
49. Some member bodies may wish to offer their own courses, or to supplement courses at post-secondary institutions with their own training programs or employer-provided training programs. This might be necessary where there are not sufficient resources at post-secondary institutions to offer some parts of the required program of studies or to supplement theoretical knowledge obtained at post-secondary institutions with practical experience.

### **The USER Role**

50. Users of various information technologies employ information systems tools and techniques to help them meet their objectives or to help others meet their objectives. These objectives, and hence the types and uses made of IT tools and techniques, can be infinite in their variety. Some typical tasks that users carry out with the help of IT include gathering and summarizing data, choosing alternative courses of action on the basis of analyses applied to data, devising strategies and tactics, planning and scheduling operational activities in an organizational unit, directing the allocation of resources, implementing operations, evaluating performance, documenting observations, judgments and decisions, and communicating with others.
51. All professional accountants must be familiar with these broad tasks and the way in which information technologies and systems can be applied to their completion.
52. In addition to knowledge of broad uses of IT, candidates for membership in professional accountancy bodies require specific knowledge of key concepts and practical skills relevant to the tools and techniques that are widely used by professional accountants and must meet these educational requirements prior to qualification.

### *Theoretical Content*

53. Professional accountants as users of IT are exposed to a wide array of information systems architectures, hardware, software and data organization methods. Information systems come in a variety of forms because they are designed to suit the needs of specific organizations. While no user could be an expert in every type of information system architecture, hardware, software or data organization, there are nevertheless fundamental knowledge and skill sets that all accountants must have.
54. In addition to the general education requirements outlined in paragraphs 40-

49, professional accountants, as users of IT, must have the background knowledge and familiarity with information systems concepts and terminology that would enable them to make reasonable decisions in connection with simple systems such as defining their needs, identifying alternatives, deciding whether to acquire a pre-packaged system or develop the system using end-user tools such as spreadsheet packages or database packages, or outsource the development to another branch of the organization or an outside consultant, and selecting the appropriate hardware, software, and supplier.

55. As users of IT, professional accountants must also know how to test and assess the acceptability of a particular system being acquired or being developed for their use and how to operate and manage such a system and keep it up to date.
56. Professional accountants must have the knowledge of basic processes used to keep their system resources organized, and of control processes and practices for safeguarding their systems and data against errors, theft, unauthorized use, software piracy, virus attacks, vandalism and system failure.

### *Practical Content*

57. Professional accountants may use information systems in a variety of contexts. They may be exposed to systems ranging from centralized to decentralized systems, from mainframe to micro platforms, from simple end-user-oriented pre-packaged software to complex custom-tailored software, and from simple data files to complex multi-user, geographically distributed databases. Given this reality, it is impractical and undesirable to prescribe a fixed comprehensive set of user skills for the practical content of a recommended accounting curriculum for all aspiring professional accountants.
58. Nevertheless, there are certain fundamental skills that are widely regarded as the minimum set of skills that all professional accountants must have prior to qualification:
  - ability to use a word processing package;
  - ability to use a spreadsheet package;
  - ability to use e-mail software and a web browser;
  - ability to use a database package; and
  - ability to use at least one basic accounting package.

Ideally, these skills would be developed in an accounting context, such as through their use in connection with an accounting course or an assignment in the work place.

59. As well, where feasible, the professional accountant should have experience with at least two different types of systems architectures, for example, a single-user standalone micro computer in a business context and a multi-user local area network system.
60. In addition, the aspiring professional accountant should be able to access and

retrieve information from an on-line or local database such as a professional research tool utilizing CD-ROM or other data storage medium and have experience in using the Internet for information retrieval.

61. Appendix 3 to this Guideline outlines a number of additional knowledge and skill areas which would be desirable, depending on the accountant's work domain.
62. It is estimated that the equivalent of one course, as described in paragraph 46, would be required to enable an aspiring accountant to develop the user skills outlined in paragraphs 53-61. The development of user-oriented knowledge and skills could be spread over and integrated into courses which are not specifically identified as IT courses. Because many of the user-oriented education requirements involve practical skills, they would be best met through a combination of in-class instruction and practical application of skills in a professional work environment.

### **The MANAGER Role**

63. Many professional accountants are involved in financial management roles which bring them into contact with information systems. Although the growth of IT has spawned many new groups of professionals, including professional information system managers, many accountants in small and medium organizations fulfill information system management functions, in partnership with other managers, or as part of their overall responsibilities.
64. In this capacity, the professional accountant's responsibilities may include participation in strategic planning for use of information systems to support entity objectives, membership on an information systems steering committee, evaluating potential investments in information technologies, developing operational priorities, exercising control over information system productivity, service quality, and economy of information system use.

### *Theoretical Content*

65. To support their role as managers of information systems, professional accountants must have a sound understanding of the business functions that information systems can fulfill and the related managerial processes of planning and co-ordinating, organizing and staffing, directing and leading, controlling and communicating in an IT context.
66. The professional accountant must, therefore, have a conceptual understanding of information system technology issues of importance to different types of entities and environments, and in particular, the following:
  - strategic considerations in IT development;
  - administrative issues;
  - financial control over IT;
  - operational issues;
  - security, backup and recovery;

- management of system acquisition, development and implementation;
  - management of system maintenance and change; and
  - management of end-user computing.
67. Appendix 4 to this Guideline addresses these topics. At the prequalification stage, these concepts would be covered at a general level, focusing on the acquisition of general knowledge and understanding of information system management principles and practices related to issues such as those outlined in the previous paragraph.
68. At the prequalification stage, only general familiarity would be required in connection with the topics listed under the column headed “Key sub-topics” in Appendix 4 to this Guideline.

### *Practical Content*

69. To support their role as managers of information systems, professional accountants must have effective practical skills in planning and co-ordinating, organizing and staffing, directing and leading, and monitoring and controlling. Both the educational material and the prequalification job content should provide aspiring professional accountants with opportunities to obtain the requisite practical IT skills prior to qualification. Education programs could use case studies, interactions with experienced professionals, and similar techniques to help develop practical skills. On-the-job training in a junior managerial capacity could also provide hands on experience with the topics listed in Appendix 4 to this Guideline.
70. In addition to the IT skills listed in Appendix 4 to this Guideline, the professional accountant’s skills must include the communication skills and interpersonal skills required to support the manager’s interactions with top management, users, steering committees, and suppliers of information system services, both internal employees and external contractors. In contrast with general communication and interpersonal skill requirements, these skills must be developed in an IT context.
71. It is estimated that, in addition to the general education requirements and the user-oriented requirements, the equivalent of one course, as described in paragraph 46, would be required to enable an aspiring accountant to develop the knowledge and skills outlined in paragraphs 65-70.

### **The DESIGNER Role**

72. Professional accountants, as employees or external advisors, have been involved in the design of financial systems for decades. In the past, such design roles have been in the context of manual record-keeping systems. Today, accountants are expected to continue to provide similar services, albeit in an IT context. This may be as a member of an in-house team or task force working to establish business system requirements, as a member of an in-house system development team for an employer, or as an external advisor helping to design a business system for a client.
73. Professional accountants’ design activities will often emphasize the

identification of user needs, consideration of costs and benefits of proposed solutions, the appropriate selection and combination of hardware, pre-packaged software, essential control features, and other system components, and the effective implementation and integration of acquired or developed systems with business processes. In this capacity, professional accountants need a sound understanding of business systems and the capabilities of various information technologies to support an organization's objectives, whether it is a profit-oriented, not-for-profit or public sector organization.

### *Theoretical Content*

74. In their design role, professional accountants must know the basic steps to be followed in the design of a system such as:
  - role of information in organization design and behavior;
  - system analysis and design techniques; and
  - system development life cycle phases, tasks and practices, particularly maintaining control over system development processes, incorporating controls within systems, and maintaining controls over system changes.
75. The professional accountant must be aware of standards and preferred practices, particularly internal control practices, that could guide information system design practices.
76. A professional accountant's knowledge of information systems must be developed in the context of gaining an understanding of organizations' business and service objectives and their environments. Thus, education programs and courses aimed at developing system design knowledge must have a managerial rather than a technical orientation.

### *Practical Content*

77. It is generally not sufficient for a professional accountant to be familiar solely with the concepts relating to the major phases of system development and the specific tasks required in each phase. A number of important practical skills are also part of the required preparation for this role.
78. While at the prequalification level the depth of practical skill that a candidate could acquire in connection with the design role would, of necessity, be limited, it is nevertheless desirable for candidates to have practical exposure to some of the important techniques that are used in key phases of system design. Both the educational material and the prequalification job content should provide aspiring professional accountants with opportunities to obtain the requisite practical IT skills prior to qualification. Education programs could use case studies, interactions with experienced professionals, and similar techniques to help develop practical skills. On-the-job training could also provide hands on design experience prior to qualification.
79. Since system design skills are generally applied in an interactive context, interpersonal and communication skills in an IT context are an essential ingredient of the skill set required to support the professional accountant's information system design role.

80. A professional accountant's information system design skills must be developed in the context of designing systems to meet organizations' business and service objectives. Thus, IT education programs and courses aimed at developing practical system design skills must have a managerial rather than a technical orientation.
81. While some practical exposure to specific techniques is desirable, the main emphasis in IT education programs aimed at developing system design skills must be on higher order skills necessary to provide effective advisory services such as the ability to analyze design problems, synthesize user information and control requirements and evaluate alternative designs in light of an entity's business or service objectives.
82. Appendix 5 to this Guideline addresses the knowledge and skill requirements related to the designer role. At the prequalification stage, the coverage of these topics would be aimed at developing general knowledge and understanding of the key tasks that must be accomplished, the documentation requirements, the risks that are inherent in each of these phases and the related control requirements. The risks may be economic, technological, operational or behavioral and all of these risks must be addressed in the education program.
83. At the prequalification stage, only general familiarity would be required in connection with the topics listed under the column headed "Key sub-topics" in Appendix 5 to this Guideline.
84. It is estimated that, in addition to the general education requirements and the user-oriented requirements, the equivalent of one course, as described in paragraph 46, would be required to enable an aspiring accountant to develop the knowledge and skills outlined in paragraphs 74-83.

#### **The EVALUATOR Role**

85. The role of the accountant as evaluator encompasses the functions of internal audit, external audit and other evaluative roles filled by accountants, whether or not formally identified as audit roles.
86. In these capacities, professional accountants may be engaged for a variety of purposes, including determining the degree of information system effectiveness in achieving organizational objectives, determining the degree of information system efficiency in achieving organizational objectives, determining the fairness of financial representations and the accuracy and completeness of related accounting records, determining the degree of compliance with management policy, statutes or other relevant authoritative regulations, and evaluating internal control strengths and weaknesses, in particular with respect to financial reporting processes, asset safeguarding, data integrity, information security and privacy, and continuity provisions for information system processing.

#### *Theoretical Content*

87. In their evaluator role, professional accountants must possess knowledge of legal, ethical, auditing and control standards relevant to IT and must be able

to distinguish between various information systems evaluation objectives and approaches such as:

- evaluation of efficiency/effectiveness/economy of IT use;
  - evaluation of compliance with management policy, statutes and regulations;
  - evaluation of internal control in computer-based systems; and
  - evaluation of the fairness of financial representations and the accuracy and completeness of related accounting records.
88. Appendix 6 to this Guideline addresses these topics. At the prequalification stage, these concepts would be covered at a general level, focusing on the acquisition of general knowledge and understanding of the key phases and related IT evaluation techniques that could be used for carrying out the engagement types relevant to the primary work domain of the member body, as well as the limitations of those techniques.
89. At the prequalification stage, the skill level requirements in this area would be based around the member body's principal orientations. For example, if the orientation were towards public accounting, the skill level requirements would focus primarily, although not exclusively, on the IT concepts involved in a financial statement-oriented attest audit. If the orientation were towards management accounting, less emphasis would be given to such topics and more emphasis would be given to the IT concepts involved in, for example, evaluating effectiveness and efficiency of information systems and their compliance with relevant policies, statutes and regulations.
90. Since evaluation procedures in an IT context may require the use of computer-assisted tools and techniques, all aspiring candidates working in an evaluative capacity must have an understanding of the types of computer-assisted tools and techniques available, their strengths and limitations and their design, execution and control requirements.

#### *Practical Content*

91. Practical IT skills in connection with the accountant's role as evaluator would depend on the evaluation objective. For example, in a public accounting context the skill level requirements would focus primarily on the IT skills involved in a financial statement-oriented attest audit such as:
- the ability to obtain and document an understanding of the flow of transactions and elements of the control structure relevant to the audit;
  - the ability to test and evaluate relevant information systems controls over financial reporting processes and asset safeguarding; and
  - the ability to test computer-based records to establish their accuracy and to substantiate financial representations.

92. In a management accounting context less emphasis would be given to such requirements and more emphasis would be given to IT skills such as:
- the ability to evaluate effectiveness and efficiency of information systems; and
  - the ability to assess the degree to which an information system meets the needs of users and serves the objectives of the entity.
93. All professional accountants involved in an evaluative role at the prequalification stage must have the ability, with limited supervision, to plan, execute and communicate the results of an evaluation approach tailored to the specific types of evaluations relevant to their work domain in the context of specific circumstances that involve information systems.
94. All professional accountants involved in an evaluative role at the prequalification stage must also have the ability to plan, execute and communicate the results of applying at least the following computer-assisted auditing techniques:
- audit software
  - test data
95. Since evaluation skills are exercised in an interactive context, interpersonal and communication skills are essential ingredients of the education program aimed at supporting a professional accountant's role as evaluator.
96. At the prequalification stage, only general familiarity would be required in connection with the topics listed under the column headed "Key sub-topics" listed in Appendix 6 to this Guideline.
97. It is estimated that, in addition to the general education requirements and the user-oriented requirements, the equivalent of one course, as described in paragraph 46, would be required to enable an aspiring accountant to acquire the knowledge and skills outlined in paragraphs 87-96.

## **POSTQUALIFICATION IT KNOWLEDGE AND SKILL REQUIREMENTS**

### **Introduction**

98. This part of the Guideline addresses postqualification IT knowledge and skill requirements. In general, this part of the Guideline focuses on higher levels of knowledge and addresses more specialized skill sets.
99. In the postqualification curriculum, accountants may choose to continue working in the same domain as prior to qualification, to change to another area or to focus on some more specialized aspect of a more general role. For example, a management accountant who initially qualifies as an accountant in the public sector domain may subsequently choose to work in industry. Similarly, an individual who initially qualifies as a public accountant may eventually choose to work primarily in a management advisory capacity in connection with a specific industry or in connection with a specific hardware or software platform.

100. Postqualification education requirements related to IT are oriented to ensuring that standards of competence and service quality are maintained by professional accountants in their chosen field of IT-related activity after qualification.

### **Continuing Professional Education**

101. Continuing professional education (CPE) is necessary to maintain professional competence in the rapidly changing IT field. CPE can include self-study, teaching, lecturing and presentations, publication of articles, monographs and books, participation in workshops, seminars, conferences, professional meetings and similar activities, and formal courses provided by colleges, universities, professional associations, and software and hardware vendors.
102. Because the IT field is subject to continuing change, all professional accountants must maintain their professional competence in connection with IT subsequent to qualification through appropriate CPE as required by their particular IT-related activities. Alternatives that could be considered range from voluntary CPE to monitored voluntary CPE to mandatory CPE activities. IFAC recommends that member bodies work towards developing mechanisms for recording and monitoring the CPE activities of their members.
103. After qualification, all professional accountants must, at a minimum, maintain their knowledge and skill levels as users of IT in their particular work domain. In addition, if their area of activity involves management, design or evaluation of information systems, they must maintain the knowledge and skill levels identified for these roles in this section of the Guideline.
104. Professional accountants' areas of activity may be more specialized than these three broad roles. IFAC recommends that, where appropriate, member bodies work towards developing IT-related CPE requirements for such other work domains related to IT to ensure that a minimum level of service quality is maintained.

### **Specialization**

105. After qualification, some professional accountants will choose to focus their involvement with IT by specializing. Examples of specialist areas which are not themselves IT fields, but are fields in which the use of IT may be significant, include treasury and finance, financial planning services, taxation, insolvency and reconstruction, and small business advisory services. Examples of specialist areas which are IT fields are business system development and integration, information system privacy and security, and various areas of industry specialization such as financial institution information systems, health care information systems, and so on.
106. Member bodies may wish to recognize the qualifications of members who have achieved specialist status in a recognized domain of IT activity by granting them specialist designations or other appropriate recognition.

107. Specialist status would normally be achieved through an appropriate combination of prescribed theoretical education, practical skills development, and specific experience in a specialized work domain. Supervised practical experience of a reasonable duration in a given area and, in some cases, tests of professional competence at the specialist level, should be required to qualify the accountant as a specialist.
108. The following sections discuss postqualification knowledge and skill level requirements for each of the four roles identified earlier.

### **The USER Role**

109. Appendix 3 to this Guideline addresses the topics relevant to this role. At the postqualification stage, professional accountants as users of IT will likely focus their use of IT by specializing in the use of particular information technologies that are most appropriate to their work domain.

#### *Theoretical Content*

110. At the postqualification stage, professional accountants as users of IT must have a sound conceptual knowledge of the information technologies that are most appropriate to their work domain. For example, management accountants must have a reasonable knowledge of the major types of business systems in use, their inherent risks, and effective internal control practices. Professional accountants working in the tax advisory services domain must have a reasonable knowledge of the main personal and corporate tax preparation packages, their strengths and weaknesses, electronic filing systems, tax planning software and tax research databases. Auditors must have a reasonable knowledge of the main computer-assisted auditing techniques, their strengths, requirements and limitations.

#### *Practical Content*

111. At the postqualification stage, professional accountants as users of IT must have practical skills in the use of relevant information technologies. For example, all professional accountants should be able to utilize Internet tools for professional research and communication. Professional accountants serving in an audit role should be able to use at least one major computer-assisted auditing package, a work paper generation package, an on-line or local database system or professional research tool and relevant time management technologies such as time keeping and billing systems. Professional accountants working in the tax advisory services domain should have a working knowledge of at least one personal and one corporate tax preparation package and, where feasible, have practical training in the use of an electronic filing system, tax planning software and a tax research database.

### **The MANAGER Role**

112. At the postqualification stage, professional accountants as managers of information systems will be involved in the specific information technologies that are used in their work domain. Nevertheless, there are general knowledge

and skill requirements that are common to all accountants employed as managers of information systems. Appendix 4 to this Guideline addresses the topics relevant to this role.

113. At the postqualification stage, the level of knowledge and skill requirements would include mastery of the topics identified in Appendix 4 under the column headed “Main topic coverage” and the topics listed under the column headed “Key sub-topics.”

#### *Theoretical Content*

114. At the postqualification stage, professional accountants serving as managers of information systems must have a sound understanding of the business functions that information systems can fulfill and the related managerial processes of directing, leading, controlling and communicating in an IT context. The professional accountant must therefore have a fairly detailed understanding of information system organizations best suited to different entities, approaches to IT staffing, budgeting, personnel development and performance evaluation, computer system operations procedures and controls, including environment controls, security, backup and recovery procedures, project management techniques and controls applicable to information systems projects.
115. The level of knowledge required is that necessary to effectively apply the practical skills required to manage in an information system context.

#### *Practical Content*

116. At the postqualification stage, professional accountants serving as managers of information systems must be able to plan and co-ordinate, organize and staff, direct and lead, and monitor and control. These skills include communication skills and interpersonal skills required to support the manager’s interactions with top management, users, steering committees, and suppliers of information system services, both internal employees and external contractors. In contrast with general communication and interpersonal skill requirements, these skills must be developed in an IT context.
117. The skill level requirements are the ability to manage information systems professionally, adhering to sound business practices and applicable statutes, standards and guidelines.

#### **The DESIGNER Role**

118. At the postqualification stage, professional accountants as designers of information systems will be involved in a variety of specific information technologies. Nevertheless, there are general knowledge and skill requirements that are common to all accountants employed as designers of business systems. Appendix 5 to this Guideline addresses the topics relevant to this role.
119. At the postqualification stage, the level of knowledge and skill requirements would include mastery of the topics identified in Appendix 5 under the

column headed “Main topic coverage” and the topics listed under the column headed “Key sub-topics.”

#### *Theoretical Content*

120. At the postqualification level, professional accountants serving in a design capacity must know about alternative system design approaches and techniques, their strengths and weaknesses, and their suitability in a specific context. Also, professional accountants serving in this domain must have a broad familiarity with the major system architectures in use and related hardware and software systems, their strengths and weaknesses, and effective management and internal control practices. In addition, professional accountants working in this domain must have detailed knowledge of relevant codified standards, guidelines and preferred system development methods.
121. The knowledge level requirements at this stage are linked to the practical skill requirements stated as skills sufficient to enable the accountant to apply, or advise on the application of, appropriate techniques in the development of specific business systems.

#### *Practical Content*

122. At the postqualification stage, professional accountants serving in a design capacity must have significant practical exposure to some of the important techniques that are used in key phases of system design, such as preparation of a feasibility study, information requirements elicitation and documentation techniques, data file design and documentation techniques, and document, screen and report design techniques.
123. The skill level requirements at this stage are the ability to apply, or advise on the application of, appropriate system techniques, particularly internal controls, in the development of specific business systems without supervision.

#### **The EVALUATOR Role**

124. At the postqualification stage, professional accountants as evaluators of IT will be involved in the specific evaluations conducted in their work domain. Nevertheless, there are general knowledge and skill requirements that are common to all accountants employed as evaluators of information systems. Appendix 6 to this Guideline addresses the topics relevant to this role.
125. At the postqualification stage, the level of knowledge and skill requirements would include mastery of the topics identified in the Appendix 6 under the column headed “Main topic coverage” and the topics listed under the column headed “Key sub-topics.”

#### *Theoretical Content*

126. At the postqualification stage, in their evaluator role, professional accountants must be able to distinguish between information systems evaluation issues and approaches that are appropriate for addressing specific evaluation purposes relevant in their work domain. In this regard, a professional

accountant must have detailed knowledge of the steps involved in applying a particular evaluation approach in an IT context, relevant standards and practices governing the conduct of a particular evaluation approach and the potential contribution that a particular evaluation could make in a specific context.

127. The knowledge level requirements in this area are the degree of knowledge that is required to work effectively in this domain.

*Practical Content*

128. At the postqualification stage, the professional accountant must be able to tailor standard evaluation approaches to specific contexts and to offer practical recommendations for information system improvement where appropriate. In addition, the accountant must be able to apply relevant IT tools and techniques when conducting the evaluation process.
129. The skill level requirements in this area are that the accountant have the ability to plan, execute and communicate the results of an evaluation approach in an IT context without supervision, while meeting relevant professional standards governing the particular evaluation objective.

**Appendices**

**Core IT Knowledge and Skill Areas for  
Professional Accountants by Role**

This section contains the following appendices:

General Information Technology Education Requirements-	
Information Technology Concepts for Business Systems .....	1
General Information Technology Education Requirements-	
Internal Control in Computer Based Systems .....	2
The Professional Accountant as a User of Information Technology .....	3
The Professional Accountant as a Manager of Information Systems .....	4
The Professional Accountant as a Designer of Business Systems .....	5
The Professional Accountant as an Evaluator of Information Systems .....	6

These appendices should be read in conjunction with the Guideline. They define broad areas of knowledge and skills that should be covered in the IT curriculum of professional accountants, organized by role.

General IT Education Requirements at the pre-qualification level address the following five major content areas:

- Information technology concepts for business systems
- Internal control in computer-based systems
- Management of IT adoption, implementation and use
- Development standards and practices for business systems
- Evaluation of computer-based business systems

The General IT Education Requirements of this guideline specify that prior to qualification all professional accountants must have at least a general level of knowledge of each of the content areas identified above. For greater clarity, this appendix lists the key topics within these content areas under three columns headed "**Broad knowledge/skill area,**" "**Main topic coverage**" and "**Key sub-topics.**"

A general level of knowledge requires that professional accountants understand the meaning of the topics listed under the column headed "**Main topic coverage**" and their importance in the context of business systems. The topics listed under the column headed "**Key sub-topics**" are provided to clarify the coverage expected for each topic; however, detailed knowledge of every sub-topic listed is not required as part of the General IT Education Requirements.

In addition to the general level of knowledge required as part of the General IT Education Requirements, this guideline requires that, prior to qualification, all professional accountants acquire knowledge and skills associated with their role as users of IT and knowledge and skills associated with at least one of the roles of designer, manager and evaluator, depending on their anticipated work domain upon qualification. This Appendix contains specific sections dealing with each of these roles. The required depth of understanding of the topics listed in these sections goes beyond general knowledge and comprehension of the topics listed under the column headed "**Main topic coverage**" and requires an ability to apply the knowledge represented by the associated "**key sub-topics**" in an appropriate client or employer setting with limited supervision.

At the post-qualification stage, this guideline requires that professional accountants who practice in a specialized domain have mastery of the topics required by their specialized practice in the role of user, designer, manager or evaluator. Thus, all professional accountants would be expected to have detailed understanding of the listed knowledge and skill areas, topics and sub-topics associated with the role represented by their area of practice or employment, the ability to apply the relevant skills in a particular domain without any supervision and the ability to supervise others in the performance of key role-related tasks.