جمهورية مصر العربية
وزارة التعليم العالي والبحث العلمي
Ministry of Higher Education and Scientific Research

The Higher Future Institute for Specialized Technological Studies

Computer Science Department

Bachelor of Computer Science

Credit Hours Program Specification

Bylaw 2018

Contents

A. Basic Information

1. **Program Name:** Bachelor of Computer Science (Credit Hours System)
2. **Program Type:** Single
3. **Department in charge of the program:** Computer Science
4. **Date of program approval: 2018/2019**
5. **Date of Program Specification Approval:**
    - Department Council Approval: num.(8) date: 24/7/2024
    - Institute Council Approval: num.(84) date: 13/8/2024
6. **Program Coordinator:** Dr. Fatma Harby Mohamed
7. **Internal Reviewer of the Program:** Dr. Manal Ahmed

B. Professional Information

1. Program Mission

The Bachelor of Computer Science program at the Higher Future Institute for Specialized Technological Studies aims to prepare qualified graduates specialized in computer science to compete in local and regional markets.

2. Program aims:

1. Present distinguished education in the computer science field that is consistent with academic standards and community requirements.
2. Provide students with basic knowledge in the basic sciences and computer science to become valued professionals who can analyze and solve computing problems.
3. Enable students to formulate and solve various computing problems using appropriate quantitative and qualitative techniques to reach time and cost-effective solutions that meet specific needs while considering professional ethical aspects.
4. Provide students with the practical skills necessary to design and develop software systems using different programming languages, and trade-off between available design choices, to be able to compete in the labor market.
5. Provide students with the ability to integrate electronic and digital systems for various software applications and identify the tools necessary to improve this design.
6. Empower students with the basic knowledge of cutting-edge technology and its applications.
7. Equip students with the ability to plan and supervise the implementation of software projects using contemporary programming technologies and respecting other disciplines' requirements, quality guidelines, health and safety requirements, environmental issues, and risk management principles.
8. Provide students with effective communication skills to be able to work efficiently within a multidisciplinary group with a team spirit, respect legal and ethical principles and societal concerns.
9. Prepare students capable of using creative, critical, and flexible thinking and acquiring a spirit of initiative and leadership by applying and developing new knowledge and practicing self-learning.
10. Present a student who can contribute to the development of his/her community and drive scientific and societal advancement through technological innovation and entrepreneurship.
11. Prepare a student who can complete postgraduate studies or professional certificates and scientific research in the field of computer science.

3. Graduate attributes:

Our program (B.SC degree) in Computer Science is designed to provide the students with the foundations of the discipline as well as the opportunity for specialization. After completing the program successfully, the graduate will have the ability to:

A.1. Apply the fundamental theories and principles of computer science such as algorithms, design and analysis, computational theory, computer architecture and software based systems with the ability to use this knowledge to devise, specify, design, implement, test, document and critically evaluate computer-based systems.

A.2. Integrate and use different computing tools and thinking methods to analyze and solve computing problems.

A.3. Use fundamental concepts of mathematics and science to solve a wide range of real-world problems; as well as to analyze and interpret data.

A.4. Apply knowledge of mathematics and computer science theory in the modeling, designing, and analyzing of computational systems to meet the required needs within realistic constraints.

A.5. Understand and apply a broad range of up-to-date software engineering tools (such as design methodologies, choice of algorithm, language, software libraries and user interface technique).

A.6. Demonstrate an understanding of algorithms and data structures, computer organization and architecture, programming language concepts, compilers, networks, artificial intelligence, graphics, , natural language processing, data mining, human computer interfaces, and databases, and identify and define the computing requirements for its solution.

A.7. Formulate, and develop computer-based software systems, in a way that demonstrates the tradeoff involved in design choices, to meet a given set of computing and information industry requirements in the context of the solution correctness, time complexity, the use of quality guidelines, and risk management principles.

A.8. Understand professional responsibilities and use management skills to make informed judgments in professional practice based on legal and ethical principles and societal concerns.

A.9. Examine and address the effects of computing and information theories and applications on the individual, society, environment, organization, and economy.

A.10 Communicate effectively, present and document ideas and concepts clearly and in an organized manner.

A.11. Engage independent learning skills and scientific research and encourage an appreciation of the importance to computer science professionals of continuing professional development and lifelong learning.

A.12. Work effectively in teams in designing and implementing software systems and to be able to carry out a work plan with minimal supervision.

4. Career Paths

A bachelor degree in computer science can open up opportunities to work in many number of career paths, including:

1. **Designing and implementing software**: which include web development, interface design, security issues, mobile computing, and so on.
2. **Devising new ways to use computers**: which include advanced graduate work, followed by a position in a research university or industrial research and development laboratory; it can involve industrial activity or it can involve a combination of the two.
3. **Developing effective ways to solve computing problems**: which refer to the application or development of computer science theory and knowledge of algorithms to ensure the best possible solutions for computationally intensive problems.
4. **Planning and Managing Organizational Technology Infrastructure:** which refer to the new information technology (IT) programs explicitly aim to educate students.
5. **Applications:** This is the type of work in organizations for which the new programs such as: operations research, scientific computing, bioinformatics, medical applications, networking and gaming and animation, explicitly aim to educate students.

5. Intended Learning Outcomes (ILOs)

The program provides students with opportunities to develop and demonstrate knowledge and understanding, intellectual, professional and practical, and transferable skills as listed below. These outcomes have been developed with reference to the National Academic Reference Standards (NARS) for COMPUTER SCIENCE, 1st Edition, October 2010 benchmark statement. Learning outcomes are statements on what successful students should achieve as the result of learning. They are linked to the knowledge, understanding, and skills that a student will have gained upon completing a program successfully.

a) Knowledge and Understanding

By the end of bachelor of computer science program the graduate should be able to:

a.1 Recognize the essential ideas, and theories of mathematics and basic science relevant to computer science.

a.2 Use principles of computing technology to model and design of computer-based systems bearing in mind the trade-offs.

a.3 Demonstrate strong knowledge of fundamentals of programming, the design, implementation, and assessment of computer-based systems.

a.4 Define criteria and specifications appropriate to specific problems, and plan strategies for their solution.

a.5 Identify the degree to which a computer-based system satisfies the requirements set forth for both its present use and its potential future development.

a.6 Recognize the current and underlying technologies that support computer processing and inter-computer communication

a.7 Describe the principals of generating tests which investigate the functionality of computer programs and computer systems and evaluating their results.

a.8 Comprehend the fundamentals of legal, professional, ethical issues, and moral aspects of the exploitation of computing as they relate to the fields of computing and information.

a.9. Recognize the moral, ethical, and professional issues associated with the exploitation of computer technology, and follow the proper legal, ethical, and professional guidelines specific to the computing and information industries.

a.10 Utilize recent advancements in computing and information research.

a.11 Show a critical understanding of requirements and real-world practical constraints of computer-based systems.

a.12 Explain the concepts and principles of statistical and mathematical analysis, including linear algebra, discrete mathematics and statistics.

a.13 Understand and trace the execution of programs written in high-level programming language.

a.14 Utilize the appropriate mathematical principles to develop predictive, prescriptive machine learning models and design the algorithms.

a.15 Order and interpret data using both qualitative and quantitative methods.

a.16. Know and understand the fundamentals and techniques of several application areas informed by the research directions of computer science.

a.17 Demonstrate strong knowledge of fundamentals of Data Warehousing, data structures and algorithms.

a.18. Demonstrate a critical understanding of the principles of the artificial intelligence, image Processing, and Pattern Recognition.

a.19 Recognize the basic concepts of computer science, such as operating systems, compilers, parallel and distributed processing, systems, real time Systems, hardware and software architectures, software engineering principles and methodologies, and software tools.

a.20 Show a critical understanding of the principles of image Processing, Machine Learning, Neural Networks, Virtual Reality, computer networks, Natural language processing, data mining, databases, computer graphics, cloud computing, computer security and compiler theory.

a.21 Understand and apply certain techniques that can be gained by choosing advanced topics including hardware systems design, object-oriented analysis and design, and artificial intelligence, parallel and concurrent computing.

b) Intellectual Skills

By the end of bachelor of Computer Science program the graduate should be able to:

b.1 Analyze and evaluate a range of options in producing a solution to an identified problem.

b.2 Apply the concepts, principles, theories and practices underpinning computing as an academic discipline.

b.3 Define and assess criteria to measure the appropriateness of a computer system for its current deployment and future evolution, and to interpret the results thereof.

b.4 Analyze, suggest, and assess alternative computer systems and processes considering restrictions and quality constraints.

b.5 Construct concepts, plans, and designs for the presentation of computing systems by employing logical and well-reasoned arguments.

b.6 Interpret test findings to evaluate how well computer systems work.

b.7 Make decisions that take into account the environmental impact, safety, quality, dependability, and balance of costs and benefits.

b.8 Have comprehensive, in-depth knowledge regarding crucial issues (professional, legal, moral, and ethical) in computer science.

b.9 Assess research articles in various fields of expertise.

b.10 Identify traditional and non-traditional problems and formulate solutions for them with observing results.

b.11 Compare between different (algorithms, methodologies, methods, etc.).

b.12 Classify the different scientific approaches (methods, methodologies and algorithms).

b.13 Identify attributes, elements, relationships, patterns, primary concepts, and errors.

b.14 Compare and summarize the proposed solutions of computing problems and their results.

b.15 Restrict characteristics of solution or its methodologies that impacted the interpretation of their findings.

b.16 Create measurable, realistic, and time-bound criteria to evaluate solutions and their performance, aligning with the problem statement, goals, and stakeholder expectations.

b.17 Generate a range of solutions for solving a significant computational problem that is ethical, feasible, and adds value, and which are based on pertinent background research and appropriate design.

b.18 Create and/or justify designs of software systems to solve problems containing a range of commercial and industrial constraints.

b.19 Generate a creative design for a software system using appropriate design principles and patterns while considering the principles of security by design and quality assurance.

c) Practical and Professional Skills

By the end of bachelor of Computer Science Program the graduate should be able to:

- **c.1** Operate computing equipment efficiently, taking into account its logical and physical properties, its capabilities, and limitations.
- **c.2**. Implement comprehensive computing knowledge and skills in projects and in deployment of computers to solve position practical problems.
- **c.3** Apply tools and techniques for the design and development of applications.
- **c.4** Utilize your retrieval skills for computing knowledge in the industry, environment, and computing community.
- **c.5** Use technological repositories, internet resources, and library-based materials to acquire a variety of basic research skills.
- **c.6** Design, execute, update, repair, and enhance software systems after they have been deployed.
- **c.7** Examine the consequences, dangers, and safety features associated with using computing equipment in a specific environment.
- **c.8** Handle a large amount of heterogeneous data, evaluate risk, and come up with results.
- **c.9** Employ suitable web-based tools and systems, database systems, design techniques, and programming languages in designing software applications.
- **c.10** Implement appropriate programming techniques and artificial intelligence algorithms.
- **c.11** Communicate effectively in a variety of professional contexts through verbal, written, and visual methods.
- **c.12** Acquire and manage information utilizing web resources and scientific publications.
- **c.13** Make and present workshops with a high level of professionalism.
- **c.14** Develop a range of fundamental research skills, through the use of online resources, technical repositories and library-based material.
- **c.15** Prepare technical reports and a dissertation to a professional standard, demonstrate advanced computer literacy, and utilize IT abilities.
- **c.16** Create an innovative and creative design for computer-based systems using appropriate design principles and patterns.
- **c.17** Use computing theory and programming principles for practical software design and development.
- **c.18** Assess systems based on the general quality characteristics and potential trade-offs that are offered in the given problem.
- **c.19** Apply knowledge of computing, mathematics, software development, networking and management principles, and methodologies within technical domains.
- **c.20** Analyze information in all its forms, including text, images, sound, and video, by using the concepts of efficient information management, information organization, and information retrieval techniques.

c.21 Analyze the factors affecting the confidentiality of information to ensure the availability and integrity of information security, including the physical equipment, software, and policies used, as well as the ability to analyze these factors in designing applications.

c.22 Employ the concepts of human-computer interaction for assessing and developing a variety of resources, such as web pages, multimedia systems, and user interfaces.

c.23 Estimate any potential dangers or safety issues that arise from using computer technology in a particular environment.

c.24 Use software development and documentation tools efficiently, paying special attention to comprehending the entire process of employing computers to solve practical problems.

c.25 Adapt and extend computational skills to new contexts as needed in their path (e.g., using a different editor/IDE, finding and using appropriate code libraries, learning a new programming language, or computational workflow).

d) General and Transferable Skills

By the end of bachelor of Computer Science Program the graduate should be able to:

d.1 Manage one's own lifelong learning and ongoing professional development through using a variety of learning resources efficiently.

d.2 Collaborate effectively within multidisciplinary team.

d.3 Work in stressful environment and within constraints.

d.4 Lead and motivate individuals.

d.5 Search for different scientific terminologies related to computing practices and adopt lifelong self-learning.

d.6 Prepare and deliver reports for a variety of audiences, such as management, technical, users, industry, or the academic community, using a suitable combination of tools and aids.

d.7 Demonstrate suitable numeracy skills in understanding and presenting cases involving a quantitative dimension.

d.8 Communicate effectively by oral, written and visual means.

d.9 Communicate effectively with team members, managers and customers.

d.10 Work effectively as an individual and as a member of team and respect teamwork.

d.11 Manage tasks and resources.

d.12 Demonstrate efficient IT capabilities.