Computer Science

Undergraduate Program

2023-2024

Faculty of
Computers and Information

Dept. of Computer Science

Assiut University

Faculty of Computers & Information

Computer Science Undergraduate Program
(Credit Hours System)

2023 – 2024

CS Undergraduate Program

Table of Contents

CS Undergraduate Program Specifications

A. Basic Information

1. **Program Title:** Computer Science
2. **Program Type:** Single
3. **Faculty (Faculties):** Faculty of Computers and Information
4. **Department:** Computer Science
5. **Assistant Coordinator:** Amal Abdelazim Mohamed
6. **Coordinator:** Prof. Khaled Fathy Hussain
7. **Last date of program specifications approval:** 2023- 2024

B. Professional Information

1. Program Aims

The program aims to provide the student with both breadth and depth of knowledge in the concepts and techniques related to the design, programming, and application of computing systems. Specifically, based on the constitutions of the Computing Curricula (ACM/IEEE CS2001 and CS2008) out CS program aims to provide the student with:

I. **System-level perspective.**
The objectives associated with individual units in the body of knowledge tend to emphasize isolated concepts and skills that can lead to a fragmented view of the discipline. Graduates of a computer science program must develop a high-level understanding of systems as a whole. This understanding must transcend the implementation details of the various components to encompass an appreciation for the structure of computer systems and the processes involved in their construction and analysis.

II. **Appreciation of the interplay between theory and practice.**
A fundamental aspect of computer science is the balance between theory and practice and the essential link between them. Graduates of a computer science program must understand not only the theoretical underpinnings of the discipline but also how that theory influences practice.

III. **Familiarity with common themes and principles.**
In the course of an undergraduate program in computer science, students will encounter many recurring themes such as abstraction, complexity, and evolutionary change. They will also encounter principles, e.g. those associated with caching, (e.g. the principle of locality), with sharing a common resource, with security, with concurrency, and so on. Graduates should recognize that these themes and principles have broad application to the field of computer science and

must not compartmentalize them as relevant only to the domains in which they were introduced.

IV. **Significant project experience.**
To ensure that graduates can successfully apply the knowledge they have gained, all students in computer science programs must be involved in at least one substantial software project. Such a project (usually positioned late in a program of study) demonstrates the practical application of principles learned in different courses and forces students to integrate material learned at different stages of the curriculum. Student need to appreciate the need for domain knowledge for certain applications, and that this may necessitate study within that domain.

V. **Attention to rigorous thinking.**
This may be formal but need not be but should include discipline epitomized by the use of sound practices which include planning, tracking progress, measuring and generally managing quality; these needs to be seen to complement sound design and sound choice of techniques.

VI. **Adaptability.**
One of the essential characteristics of computer science over its relatively brief history has been an enormous pace of change. Graduates of a computer science program must possess a solid foundation that allows and encourages them to maintain their skills as the field evolves.

2. Graduate attributes

The Computer Science program is designed to provide the student with the foundations of the discipline as well as the opportunity for specialization. After successfully completing the Computer Science program, the graduate should be able to:

I. Demonstrate knowledge and competence in fundamental areas of computer science such as: algorithms, design and analysis, computational theory, computer architecture and software based systems.

II. Apply mathematical foundations, algorithmic principles, and computer science theory in the modeling and design, implementation, evaluation and evolution of computer-based systems.

III. Apply knowledge of mathematics and science to real world problems; as well as to analyze and interpret data.

IV. Demonstrate the analytic skills necessary to effectively evaluate the relative merits of software and computer systems, and algorithmic approaches.

V. Understand and apply a wide range of principles and tools of software engineering, such as design methodologies, choice of algorithm, language, software libraries and user interface technique.

VI. Understand and apply a wide range of principles and tools of natural language processing and data mining.

VII. Have a solid understanding of the used concepts in computer science to be able to pursue further learning, whether as graduate students or on their own.

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

IX. Design, implement, and evaluate a computer-based systems, process, component or program.

X. Use knowledge and understanding in the modeling and design of computer-based systems in a way that demonstrates comprehension of the tradeoff involved in design choices.

3. Intended Learning Outcomes (ILOs)

a. Knowledge and Understanding

On successful completion of the program, graduates should be able to:

a1. Recognize the essential mathematics relevant to computer science.

a2. Explain code written in high-level programming languages.

a3. Demonstrate basic knowledge and understanding of a core of mathematical analysis.

a4. Demonstrate basic knowledge and understanding of a core of statistics.

a5. Interpret and analyze data qualitatively and/or quantitatively.

a6. Describe the principles and techniques of a number of application areas informed by the research directions of computer science.

a7. Show a critical understanding of the principles of artificial intelligence, image, and pattern recognition.

a8. Define the fundamental topics in computer systems, including hardware architectures and operating systems.

a9. Define the fundamental topics in computer science, including software architectures, software engineering principles and methodologies, and software tools.

a10. Define advanced topics to provide a deeper understanding of some aspects of the hardware systems design, operating systems, computer security and compiler theory.

a11. Discuss advanced topics to provide a deeper understanding of some aspects of object-oriented analysis and design, and software engineering.

a12. Identify advanced topics to provide a deeper understanding of some aspects of the artificial intelligence, image processing, and computer graphics and animation.

a13. Express strong knowledge of fundamentals of programming and the construction of computer-based systems.

a14. Describe strong knowledge of fundamentals of data structures and algorithms.

a15. Show a critical understanding of the broad context within computing including issues such as quality, reliability, enterprise, employment law and accounting.

a16. Provide a deeper understanding of legal, professional and moral aspects of the exploitation of computing.

a17. Recognize the knowledge of tools, practices and methodologies used in the specification, design, implementation and critical evaluation of computer software systems.

a18. Define and assess criteria for measuring the extent to which a computer system is appropriate for its current deployment and future evolution.

a19. Define the current and underlying technologies that support computer processing and inter-computer communication.

a20. Define the principals of generating tests which investigate the functionality of computer programs and computer systems and evaluating their results.

b. Intellectual Skills

On successful completion of this program, graduates should be able to:

b1. Formulate traditional and nontraditional problems, set goals towards solving them, and observe results.

b2. Compare between (algorithms, methods, techniques...etc).

b3. Classify (data, results, methods, techniques, algorithms.. etc.).

b4. Identify attributes, components, relationships, patterns, main ideas, and errors.

b5. Conclude the result of the proposed solutions.

b6. Restrict solution methodologies upon their results.

b7. Compose criteria, and verify solutions.

b8. Identify a range of solutions and critically evaluate and justify proposed design solutions.

b9. Solve computer science problems with pressing commercial or industrial constraints.

b10. Generate an innovative design to solve a problem containing a range of commercial and industrial constraints.

b11. Formulate and model computer systems at different and appropriate levels of abstraction.

b12. Create and/or justify designs to satisfy given requirements (synthesis, evaluation, application).

b13. Analyze and evaluate a range of options in producing a solution to an identified problem.

b14. Analyze problem from written descriptions; derive requirements specifications from an understanding of problems (analysis, synthesis).

b15. Outline the concepts, principles, theories and practices underpinning computing as an academic discipline.

b16. Develop and assess criteria to measure the appropriateness of a computer system for its current deployment and future evolution, and to interpret the results thereof.

b17. Create ideas, proposals and designs effectively using rational and reasoned arguments for presentation to a range of audiences.

b18. Evaluate the results of tests to investigate the functionality of computer systems.

c. Professional and Practical Skills

On successful completion of this program, graduates should be able to:

c1. Use appropriate programming languages and design methodologies.

c2. Use appropriate web-based systems, tools and design methodologies.

c3. Use appropriate database systems.

c4. Perform independent information acquisition and management, using the scientific literature and Web sources.

c5. Specify, design, and implement computer-based systems.

c6. Evaluate systems in terms of general quality attributes and possible tradeoffs presented within the given problem.

c7. Apply the principles of effective information management, information organization, and information-retrieval skills to information of various kinds, including text, images, sound, and video.

c8. Apply the principles of human-computer interaction to the evaluation and construction of a wide range of materials including user interfaces, web pages, and multimedia systems.

c9. Identify any risks or safety aspects that may be involved in the operation of computing equipment within a given context.

c10. Deploy effectively the tools used for the construction and documentation of software, with particular emphasis on understanding the whole process involved in using computers to solve practical problems.

c11. Make effective use of general computing facilities, plan and manage a project to complete within budget and schedule.

c12. Appreciate and manage the need for continuing professional development in recognition of the need for lifelong learning.

c13. Address and apply professional, moral and ethical issues within the discipline.

c14. Operate computing equipment efficiently, taking into account its logical and physical properties.

c15. Use investigative skills to research new and novel aspects of their work.

c16. Apply tools and techniques for the design and development of applications.

d. General and Transferable Skills

On successful completion of this program, graduates should be able to:

d1.   Communicate effectively by oral, written and visual means.
d2.   Work effectively as an individual and as a member of a team.
d3.   Collaborate effectively within multidisciplinary team.
d4.   Work in stressful environment and within constraints.
d5.   Prepare and present seminars to a professional standard.
d6.   Prepare technical reports, and a dissertation, to a professional standard; use IT skills and display mature computer literacy.
d7.   Demonstrate efficient IT capabilities.
d8.   Lead and motivate individuals.
d9.   Manage tasks and resources.
d10. Search for information and adopt life-long self-learning.
d11. Acquire entrepreneurial skills.
d12. Manage one's own learning and development.
d13. Prepare their work in the form of reports.
d14. Communicate effectively with team members, managers and costumers.
d15. Exhibit appropriate numeracy skills in understanding and presenting cases involving a quantitative dimension.
d16. Develop a range of fundamental research skills, through the use of online resources, technical repositories and library-based material.

4. Academic standards

4a. External references for standards
The academic standards invoked in this specification are driven based on the National Academic Reference Standards (NARS) for "Computing" approved by the National Authority of Quality Assurance and Accreditation of Education on October 2010.

4b. Comparison of provision to external references
See the attached document "Program Matrices".

5. Curriculum Structure and Contents
5a. Program duration: 144 credit hours.
5b. Program structure
- No. of credit hours of Compulsory (100), Elective (44)
- No. of program Levels (in credit-hours system): 4 levels.

The following table summarizes the program structure.

Subject Area	Credit Hours	CS Program %	Tolerance
Humanities, ethical and Social Sciences (Univ. Req.)	18	12.5 %	8-10 %
Mathematics and Basic Sciences	28	19.44 %	16-18 %
Basic Computing Sciences (institution req.)	42	29.17 %	26-28 %
Applied Computing Sciences (specialization)	42	29.17 %	28-30 %
Projects and Training	14	9.72%	6-10 %
Subtotal	144	100 %	84-96 %
Optional (Institution character-identifying subjects)	15	N/A	4-16 %
Total	N/A	N/A	100 %

6. Program Courses
6a. Compulsory Courses

General requirements									
Course Code	Course name	Prerequisites	Credit	No. of hours/week			Program ILOS Covered (by No.)		
				Lect.	Lab	Exer.	a's	b's	c's	d's
HUM111	English Language I	-	2	2	-	-	-	4,14	4,10,12	1,3,6,10,12,13
HUM121	Social Context of Computing	-	1	1	-	-	1-2,15,16	1-2	1-2,13	1-4
HUM132	Interpersonal Communication	-	2	2	-	-	1-5	1-4	1-5	1-2
HUM231	Business Administration	-	2	2	-	-	1,2,15,16	1-3	1-3,13	1-7
HUM232	Technical Writing	HUM111	2	2	-	-	1-3	1-3	1-3	1-9
HUM241	Computers and Ethics	-	1	1	-	-	1-2,15,16	1-3	1-3,13	1-9

Institution requirements										
Course Code	Course name	Prerequisites	Credit	No. of hours/week			Program ILOS Covered (by No.)			
				Lect.	Lab	Exer.	a's	b's	c's	d's
MATH101	Mathematics I	-	3	3	-	2	1,2	1,6	1-3	1-3
MATH102	Mathematics II	MATH101	3	3	-	2	1-5	1-6	1-4	1-3
MATH202	Probability and Statistics	MATH102	2	2	2 H^T	-	1,2,5	1-6	1-4	1-3
CS201	Discrete Structures	MATH102	3	3	-	2	1,2	1-6	1-4	1-4
PHYS101	Physics I	-	3	2	2 H^S	-	1-6	1-4	1-6	1-6
PHYS102	Physics II	-	3	2	2 H^S	-	1-5,7	1-4	1-5	1-6
EE101	Electronics	-	3	2	2 H^S	-	1-5	1-6	1-5	1-6
EE102	Digital Circuits	EE101	2	3	2 H^S	-	1-8	1,3-8	1-6	1-5

Basic Computing Sciences (Institution Requirements)										
Course Code	Course name	Prerequisites	Credit	No. of hours/week			Program ILOS Covered (by No.)			
				Lect.	Lab	Exer.	a's	b's	c's	d's
CS141	Programming Fundamentals	IT101	3	3	3HT	-	1-7,11-14	1-5	1-3	1-5
CS211	Data Structures and Algorithms	CS241	3	3	2 HT	-	1-5	1,2,10,11	1-6	1-6
CS241	Object-Oriented Programming	CS141	3	3	2 HT	-	1-4	1-5	1,2	1-6
CS321	Operating Systems	CE221	3	3	2 HT		1-3,5-8	1-5	1-5	1,2
CS351	Computer Graphics	IT101, CS201	3	3	2 HT		_	5, 6	_	8
CS361	Artificial Intelligence	IT101, CS201	3	3	2 HT		1-7	1-6,8	1-6	1-8
CS391	Software Engineering	CS211	3	3	-	2	1-10,17,20	1-3,6,9,10,12,14-18	1-6,	1-6,14-16
IS212	Databases	IS201	3	3	2 HT	-	1-7	1-5	1-6	3,5,6,1,4
IT101	IT Fundamentals	-	3	3	3 HT		1-6,8,9	1-3	1-4	1-4
IT251	Data Communications	IT101	3	3	-	2	1-4,6-7,19	1-6	1-5	1-6
IT351	Computer Networks	IT251, CE221	3	3	2 HT		1-10,19	1-15	1-6	1-6
CE221	Computer Architecture	CS141, CS201	3	3	2 HT		1-8,18,19	1-5	1-3	1-4

Specialization requirements										
Course Code	Course name	Prerequisites	Credit	No. of hours/week			Program ILOS Covered (by No.)			
				Lect.	Lab	Exer.	a's	b's	c's	d's
1st Level Courses										
CS141	Programming Fundamentals	IT101	3	3	3HT		1-7,11-14	1-5	1-3	1-5
IT101	IT Fundamentals	–	3	3	3 HT		1-9	1,2	1-4	1-4
MATH101	Mathematics I	–	3	3	-		1,2	1,6	1-3	1-3
MATH102	Mathematics II	MATH101	3	3	-		1-5	1-6	1-4	1-3
PHYS101	Physics I	–	3	2	2 HS		1-6	1-4	1-6	1-6
PHYS102	Physics II	–	3	2	2 HS		1-5,7	1-4	1-5	1-6
EE101	Electronics	–	3	2	2 HS		1-5	1-6	1-5	1-6
EE102	Digital Circuits	EE101	2	2	2 HS		1-8	1,3-8	1-6	1-5
HUM111	English Language I	–	2	2	-		-	4,14	4,10,12	1,3,6,10,12,13
2nd Level Courses										
CS201	Discrete Structures	MATH102	3	3	-	2	1,2	1-6	1-4	1-4
CS211	Data Structures and Algorithms	CS241	3	3	2 HT	-	1,4,5,2,3	2-10,11,1	1-6	1-6

Course Code	Course name	Prerequisites	Credit	Lect.	Lab	Exer.	a's	b's	c's	d's
CS241	Object-Oriented Programming	CS141	3	3	2 H^T	-	1-4	1-5	1,2	1-6
IS212	Databases	IS201	3	3	2 H^T	-	1-7	1-5	1-6,9,11	1,3-6,11,14-16
IS221	Project Management	IT101	2	2	2 H^O	-	1,2,15-17,20	1,2	1	1-6
IT251	Data Communications	IT101	3	3	-	2	1-4, 6,7	2-6	1-5	1-6
CE221	Computer Architecture	CS141, CS201	3	3	2 H^T	-	1-8,18,19	1-5	1-3	1-4
MATH202	Probability and Statistics	MATH102	2	2	2 H^T		1-5	1-6	1-4	1-3

Specialization requirements										
Course Code	Course name	Prerequisites	Credit	No. of hours/week			Program ILOS Covered (by No.)			
				Lect.	Lab	Exer.	a's	b's	c's	d's
3rd Level Courses										
CS311	Algorithm Design and Analysis	CS211	3	3	-	2	1-5	2-11	1-7,14-16	1-6
CS321	Operating Systems	CE221	3	3	2 H^T	-	1-8	1-5	1-5	1,2
CS342	Automata and Language Theory	CS141, CS201	3	3	-	2,18	1-5	1-5	1-5	1-3,5
CS351	Computer Graphics	IT101, CS201	3	3	2 H^T	-	1-7	1,3,5,6,8	1-4	1-6,8
CS352	Image Processing	CS211	3	3	2 H^T	-	1-8	1-6	1-5	1-6
CS361	Artificial Intelligence	IT101, CS201	3	3	2 H^T	-	1-6	1-8	1-6	1-8
CS381	Software Development and Professional Practice	CS211, CS391	3	3	3 H^O	-	1-10	1-15	1-6	1-6
CS382	Field Training	IS221	3	-	-	-	1-8	1-10	1-8	1-6
CS391	Software Engineering	CS211	3	3	-	2	1-10,17,20	1-3,6,9,10,12,14-18	1-6,	1-6,14-16
IT351	Computer Networks	IT251, CE221	3	3	2 H^T	-	**1-10,19**	1-5	1-7	1-9
4th Level Courses										
CS431	Parallel Computation	CS311, CS321	3	-	-	-	1-9	1-5	1-4	1-4
CS441	Compiler Construction	CS211, CS341, CE221	3	-	-	-	1-6	3-6	1-4	1-4
CS471	Introduction to Computer Security	CS211, IT351	3	3	2 H^O	-	1-8	2-6	3,4,6,7	1-4
CS481	Capstone Project I	CS381, IS221	3	1	4 H^S	-	1-8	1-10	1-8	1-6
CS482	Capstone Project II	CS381, IS221	3	1	4 H^S	-	1-8	1-10	1-8	1-6

6b. Elective Courses

General requirements										
Course Code	Course name	Prerequisites	Credits	No. of hours/week			Program ILOS Covered (by No.)			
				Lect.	Lab	Exer.	a's	b's	c's	d's
HUM112	English Language II	HUM111	2	2	-	-	1,2	1-3	1-3	1-7
HUM122	Intellectual Property	-	1	1			1,2	1-3	1-3	1-7
HUM131	Organizational Behavior		2	2			1,2	1-3	1-3	1-7
HUM133	Computing Economics	-	2	2			1,2	1,2	1,2	1,2
HUM141	Computer Law	-	2	2			1,2,15,16	1,2	1,2,13	1-7
HUM142	Privacy and Civil Liberties		1	1			**1-5**	**1-4**	**2,3**	**1-3**
HUM151	Hand Drawing		2	2	3 H^S		13, 5-14	1-3	1,2	1-4
HUM152	History of Computing		2	2			2,4,5,6,9	1,3	2-4	1-3
HUM153	Islamic Culture		1	1			1,2	1,2	1,2	1,2
HUM154	Scientific Thinking		1	1			1-4	1-5	1,2	1-4

Institution requirements										
Course Code	Course name	Prerequisites	Credit	No. of hours/week			Program ILOS Covered (by No.)			
				Lect.	Lab	Exer.	a's	b's	c's	d's
MATH201	Mathematics III	MATH102	3	3	-	2	-	6,8	16	1,2
MATH301	Numerical Analysis	MATH102	3	3	-	2	**1-3**	**1-6**	**1-7**	**1-7**
CS301	Operation Research	CS201	3	3	**2** H^T	-	1,2,3,4-7, 9	1-4	1-3	1-5
CS302	Simulation and Modeling	MATH202	3	3	**2** H^T	-	1,2,3,4-7, 8,9	1-4	1-3	1-5
EE201	Digital Signal Processing	MATH201	3	3	**2** H^T	-	**1-3**	**1-5**	**4**	**1-4**

Basic Computing Since requirements										
Course Code	Course name	Prerequisites	Credit	No. of hours/week			Program ILOS Covered (by No.)			
				Lect.	Lab	Exer.	a's	b's	c's	d's
CS341	Visual Programming	CS211	3	3	**2** H^T		1-6	1-5	1-5	1-6
IS201	Foundations of Information Systems	IT101	3	3	**2** H^T		1-8	1-11	1-6,8	1,3,4-7
IS211	File Organization	CS241	3	2	**2** H^T		2,8	2,4,8	1,5,7, 9,14	1,2,4, 8,9,11
IS231	Systems Analysis and Design	IT101	3				3,5,6,9 11,13,15,17,20	1,2, 4-8, 12,14,17	5,6,9	2,3,4,6, 8-10, 13,14
IT371	Web Programming	CS141, IT251	3				**1-8**	**1-3**	**1-5**	**1-7**

Course Code	Course name	Prerequisites	Credit	Lect.	Lab	Exer.	a's	b's	c's	d's
MM301	Introduction to Multimedia Technology	CS241	3							

	Specialization requirements									
Course Code	Course name	Prerequisites	Credit	No. of hours/week			Programe ILOS Covered (by No.)			
				Lect.	Lab	Exer.	a's	b's	c's	d's
1st Level Courses										
HUM112	English Language II	HUM111	2	2	-		1,2	2,3	1-3	1-7
HUM122	Intellectual Property	-	**1**	**1**	-		1,2	1-3	1-3	1-7
HUM131	Organizational Behavior	-	**2**	**2**	-		1,2	1-3	1-3	1-7
HUM133	Computing Economics	–	**2**	**2**	-		1-6	1,2	1-3	1-7
HUM141	Computer Law	–	**2**	**2**	-		1,2,15,16	1-5	1,3,13	1-4
HUM142	Privacy and Civil Liberties	–	**1**	**1**	-		**1-3**	**1-4**	**2-3**	**1-3**
HUM151	Hand Drawing	–	**2**	**1**	**3 H^S**		**1-4**	**1,3,4**	**1,3**	**1-3**
HUM152	History of Computing	–	**2**	**2**	-		**2-6,9**	**1,3**	**2-4**	**1-3**
HUM153	Islamic Culture	–	**1**	**1**	-		**1,2**	**1,2**	**1,2**	**1,2**
HUM154	Scientific Thinking	–	**1**	**1**	-		**1-4**	**1-5**	**1,2**	**1,2**
2nd Level Courses										
IS201	Foundations of Information Systems	IT101	3	3	**2 H^T**	-	**1-10**	**1-10**	**1-6,8**	**3-7**
IS211	File Organization	CS241	3	3	**2 H^T**	-	**1-9**	**1-4**	**1-6**	**1-6**
IS231	Systems Analysis and Design	IT101	3	3	**-**	2	3,5,6,9 11,13,15,17,20	**1-6,2-15**	**1-5**	**1-8**
MATH201	Mathematics III	MATH102	3	3	**-**	2	**1-3**	**1-6**	**1-7**	**1-7**
EE201	Digital Signal Processing	MATH201	3	3	**2 H^T**	-	**1-3**	**1-5**	**4**	**1-4**
3rd Level Courses										
CS301	Operation Research	CS201	3	3	**2 H^T**	-	**1-7,9**	**1-4**	**1-3**	**1-5**
CS302	Simulation and Modeling	MATH202	3	3	**2 H^T**	-	**1-9**	**1-4**	**1-3**	**1-5**
CS341	Visual Programming	CS211	3	3	**2 H^T**	-	**1-6**	**1-5**	**1-5**	**1-6**
CS353	Advanced Computer Graphics	CS351	3	3	**2 H^O**	-	**1-7**	**1,3,6,8**	**1-4**	**8**
IT371	Web Programming	CS141, IT251	3	**3**	**2 H^T**		**1-8**	**1-3**	**1-5**	**1-7**
MM301	Introduction to Multimedia Technology	CS241	3	**3**	**2 H^T**					
MATH301	Numerical Analysis	MATH102	3	**3**	**-**		**1-3**	**1-6**	**1-7**	**1-7**
4th Level Courses										
CS421	Advanced Operating Systems	CS321	3	**2**	**3 H^S**		**1-4**	**1-5**	**2-5**	**1-6**
CS442	Programming Language Design	CS211, CE221	**3**	**3**	**2 H^T**		**1-6**	**1-5**	**1-6**	**1-6**
CS451	Computer Animation	CS352	**3**	**3**	**2 H^T**		**1-5**	**1-3**	**1-6**	**1-4**

CS452	Computer Vision	CS241, PHYS102	3	3	2 H^T		1-3	1-4	1-3	1-5
CS461	Intelligent Systems	CS361	3	3	2 H^O		1-4	1-3	1-6	1-4
CS462	Machine Learning	CS361	3	3	2 H^O		1-4	1-3	1-6	1-4
CS463	Pattern Recognition	CS361	3	3	2 H^O		1-4	1-3	1-6	1-4
CS472	Software Quality Assurance and Testing	CS211, IT351	3	3	2 H^O		1-10	1-6,16-18	1-5	1-7
CS491	Advanced Database	CS391	3	3	2 H^O		1-4	1-6	1-2	1-6
IS411	Distributed and Object Databases		3	3	2 H^O		1-4	1-6	1-2	1-6
IS412	Data Mining and Business Intelligence	IS212	3	3	2 H^O		1-5	1-8	1-6	1-5
IS414	Wireless and Mobile Computing		3	3	2 H^O		1-9	1-6	1-5	1-7
IT431	Network Programming	IT251	3	3	2 H^O		1-6	1-6	1-5	1-7
IT432	Web Programming	IT351	3	3	2 H^O		1-8	1-3	1-5	1-7
IT371	Virtual Reality	CS141, IT251	3	3	2 H^O					
MM411	Advanced Computer Architecture		3	3	2 H^O		1-6	1-5	1-3	1-4
CE421	Embedded Systems	CE221	3	3	2 H^O		1-6,8	1-5	1,3-5	1,2
CE422	Software Quality Assurance and Testing	CE221	3	3	2 H^T		1-10	1-6,16-18	1-5	1-7

7. Contents of Courses

Syllabus: See the below

8. Program Admission Requirements

High score in secondary school education certificate in (Mathematical Section).

9. Regulations for progression and program completion

Please, refer to faculty bylaw (Curriculum of Undergraduate Programs), 2004, pages 4-5.

10. Student Assessment (Methods and rules for student assessment)

Method (tool)	Intended leaning outcomes assessed
1- Written examinations	Knowledge and Understanding - Intellectual Skills - Professional Skills - General Skills
2- Oral examination	Knowledge and Understanding - Intellectual Skills
3- Laboratory examination	Professional Skills - General Skills
4- Graduation project	Professional Skills - General Skills

5- Reports and homework	Knowledge and Understanding

11. Program Evaluation

Evaluator	Tool	Sample
1- Senior students	Questionnaires	
2- Alumni	Questionnaires	
3- Stakeholders	Questionnaires, Joint Discussion	
4-External Evaluator(s) (External Examiner(s))	Review Reports	

CS Program
Matrices

CS Undergraduate Program Matrices

The main description of Computer Science Program can be summarized in different types of matrices. These matrices are:

1. **Academic Standards Matrix**

   This matrix shows the ILOs invoked in CS Program Specifications and those existing in NARS and the corresponding between them.

2. **Program Matrix I (Courses – NARS General)**

   This matrix shows how CS Program Courses can cover the NARS general ILOs.

3. **Program Matrix II (Courses – NARS Special)**

   This matrix shows how CS Program Courses can cover the NARS special ILOs.

4. **Program Matrix III (Courses – Knowledge and Understanding Skills)**

   This matrix shows how CS Program Courses can cover Knowledge and Understanding Skills invoked in CS Program Specifications.

5. **Program Matrix IV (Courses – Intellectual Skills)**

   This matrix shows how CS Program Courses can cover Intellectual Skills invoked in CS Program Specifications.

6. **Program Matrix V (Courses – Professional and Practical Skills)**

   This matrix shows how CS Program Courses can cover Professional and Practical Skills invoked in CS Program Specifications.

7. **Program Matrix VI (Courses – Transferable Skills)**

   This matrix shows how CS Program Courses can cover Transferable Skills invoked in CS Program Specifications.

8. **Program Matrix VII (Aims – ILOs)**

   This matrix shows how CS Program ILOs can cover the program aims.

9. **Teaching and Learning Methods Matrix VIII (ILOs-Teaching and Learning Methods)**

   This matrix shows what teaching methods are covered by CS Program ILOs.

10. **Assessment Methods Matrix VIIII (ILOs-Assessment Methods)**

    This matrix shows what assessment methods are covered by CS Program ILOs

CS Program ILOs	Corresponding in NARS		NARS ILOs - General	NARS ILOs - Special
a1. Recognize the essential mathematics relevant to computer science.		A1	1. Essential facts, concepts, principles and theories relating to computing and information and computer applications as appropriate to the program of study.	A1. Understand the essential mathematics relevant to computer science.
a2. Explain code written in high-level programming languages.		A2	2. Modeling and design of computer-based systems bearing in mind the trade-offs.	A2. Use high-level programming languages.
a3. Demonstrate basic knowledge and understanding of a core of mathematical analysis.	K4	A3	3. Tools, practices and methodologies used in the specification, design, implementation and evaluation of computer software systems.	A3. Demonstrate basic knowledge and understanding of a core of analysis, algebra, applied mathematics and statistics.
a4. Demonstrate basic knowledge and understanding of a core of statistics	K4	A3	4. Criteria and specifications appropriate to specific problems, and plan strategies for their solution.	A4. Interpreting and analyzing data qualitatively and/or quantitatively.
a5. Interpret and analyze data qualitatively and/or quantitatively.		A4	5. The extent to which a computer-based system meets the criteria defined for its current use and future development.	A5. Know and understand the principles and techniques of a number of application areas informed by the research directions of the subject, such as artificial intelligence, databases and computer graphics.
a6. Describe the principles and techniques of a number of application areas informed by the research directions of computer science.	K5	A5	6. The current and underlying technologies that support computer processing and inter-computer communication.	
a7. Show a critical understanding of the principles of artificial intelligence, image, and pattern recognition.	K1	A6	7. Principals of generating tests which investigate the functionality of computer programs and computer systems and evaluating their results.	A6. Show a critical understanding of the principles of artificial intelligence, image, and pattern recognition.
a8. Define the fundamental topics in computer systems, including hardware architectures and operating systems.	K1	A7	8. Management and economics principles relevant to computing and information disciplines.	A7. Understanding of fundamental topics in Computer Science, including hardware and software architectures, software engineering principles and methodologies, operating systems and software tools.
a9. Define of fundamental topics in computer science, including software architectures, software engineering principles and methodologies, and software tools.	K1	A7	9. Professional, moral and ethical issues involved in the exploitation of computer technology and be guided by the appropriate professional, ethical and legal	
a10. Define advanced topics to provide a deeper understanding of some aspects of the hardware systems design, operating systems, computer security and compiler theory.		A8		
a11. Discuss advanced topics to provide a deeper understanding of some aspects of object-oriented analysis and design, and software engineering.		A8		

CS Program ILOs	Corresponding in NARS		NARS ILOs - General	NARS ILOs - Special
a12. Identify advanced topics to provide a deeper understanding of some aspects of the artificial intelligence, image processing, and computer graphics and animation.		A8	practices relevant to the computing and information industry. 10. Current developments in computing and information research. 11. Requirements, practical constraints and computer-based systems	A8. Select advanced topics to provide a deeper understanding of some aspects of the subject, such as hardware systems design, object-oriented analysis and design, and artificial intelligence, and parallel and concurrent computing.
a13. Express strong knowledge of fundamentals of programming and the construction of computer-based systems.	K1,K2			
a14. Describe strong knowledge of fundamentals of data structures and algorithms.	K1			
a15. Show a critical understanding of the broad context within computing including issues such as quality, reliability, enterprise, employment law and accounting.	K8			
a16. Provide a deeper understanding of legal, professional and moral aspects of the exploitation of computing.	K8,K9			
a17. Recognize the knowledge of tools, practices and methodologies used in the specification, design, implementation and critical evaluation of computer software systems.	K3			
a18. Define and assess criteria for measuring the extent to which a computer system is appropriate for its current deployment and future evolution.	K5			
a19. Define of the current and underlying technologies that support computer processing and inter-computer communication.	K6			
a20. Define of the principals of generating tests which investigate the functionality of computer programs and computer systems and evaluating their results.	K7			

Academic Standards (Intellectual Skills)

CS Program ILOs	Corresponding in NARS		NARS ILOs - General	NARS ILOs - Special
b1. Formulate traditional and nontraditional problems, set goals towards solving them, and observe results.		B1	I1. Analyze a wide range of problems and provide solutions related to the design and construction of computing systems through suitable algorithms, structures, diagrams, and other appropriate methods.	B1. Define traditional and nontraditional problems, set goals towards solving them, and. observe results.
b2. Compare between (algorithms, methods, techniques...etc).		B2	I2. Apply the concepts, principles, theories and practices underpinning computing as an academic discipline.	B2. Perform comparisons between (algorithms, methods, techniques...etc).
b3. Classify of (data, results, methods, techniques, algorithms... etc.).		B3	I3. Understand and analyze problems and evaluate computer software systems for their solution.	B3. Perform classifications of (data, results, methods, techniques, algorithms.. etc.).
b4. Identify attributes, components, relationships, patterns, main ideas, and errors.		B4	I4. 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.	B4. Identify attributes, components, relationships, patterns, main ideas, and errors.
b5. Conclude the result of the proposed solutions.		B5	I5. Analyze, propose and evaluate alternative computer systems and processes taking into account limitations, constraints, fit-for-purpose, general quality, and possible trade-offs within the parameters of the problem.	B5. Summarize the proposed solutions and their results.
b6. Restrict solution methodologies upon their results.		B6		B6. Restrict solution methodologies upon their results.
b7. Compose criteria, and verify solutions.		B7		B7. Establish criteria, and verify solutions.
b8. Identify a range of solutions and critically evaluate and justify proposed design solutions.		B8	I6. Synthesize ideas, proposals and designs effectively using rational and reasoned arguments for presentation to a range of audiences.	B8. Identify a range of solutions and critically evaluate and justify proposed design solutions.
b9. Solve computer science problems with pressing commercial or industrial constraints.		B9	I7. Generate and evaluate the results of tests to investigate the functionality of computer systems.	B9. Solve computer science problems with pressing commercial or industrial constraints.
b10. Generate an innovative design to solve a problem containing a range of commercial and industrial constraints.		B10	I8. Reach computing judgments considering balanced costs, benefits, safety, quality, reliability, and environmental impact.	
b11. Formulate and model computer systems at different and appropriate levels of abstraction.				
b12. Create and/or justify designs to satisfy given requirements (synthesis, evaluation, application).	I3, I8			
b13. Analyze and evaluate a range of options in producing a solution to an identified problem.	I5			

b14. Analyze problem from written descriptions; derive requirements specifications from an understanding of problems (analysis, synthesis).	I1	I9. To be guided by the professional, legal, moral and ethical issues relevant to the computing industry. I10. Read and evaluate research papers in a range of knowledge areas.	B10. Generate an innovative design to solve a problem containing a range of commercial and industrial constraints.
b15. Outline the concepts, principles, theories and practices underpinning computing as an academic discipline.	I2		
b16. Develop and assess criteria to measure the appropriateness of a computer system for its current deployment and future evolution, and to interpret the results thereof.	I4		
b17. Create ideas, proposals and designs effectively using rational and reasoned arguments for presentation to a range of audiences.	I6		
b18. Evaluate the results of tests to investigate the functionality of computer systems.	I7		

Academic Standards (Professional and Practical Skills)

CS Program ILOs	Corresponding in NARS		NARS ILOs - General	NARS ILOs - Special
c1. Use appropriate programming languages and design methodologies.		C1	P1. Operate computing equipment effectively, recognizing its logical and physical properties, capabilities and limitations. P2. Effectively deploy computers to solve practical problems. P3. Deploy effectively the knowledge and tools used for the construction and documentation of computer applications.	C1. Use appropriate programming languages, web-based systems and tools, design methodologies, and database systems. C2. Communicate effectively by oral, written and visual means. C3. Perform independent information acquisition and management, using the scientific literature and Web sources. C4. Prepare and present seminars to a professional standard. C5. Perform independent information acquisition and management, using the scientific literature and Web sources. C6. Prepare technical reports, and a dissertation, to a professional standard; use IT skills and display mature computer literacy.
c2. Use appropriate web-based systems, tools and design methodologies.		C1		
c3. Use appropriate database systems.		C1		
c4. Perform independent information acquisition and management, using the scientific literature and Web sources.		C3		
c5. Specify, design, and implement computer-based systems.	P2	C7		
c6. Evaluate systems in terms of general quality attributes and possible tradeoffs presented within the given problem.		C8		

c7. Apply the principles of effective information management, information organization, and information-retrieval skills to information of various kinds, including text, images, sound, and video.		C9	P4. Work effectively individually, under direct supervision and/or as part of a team.	C7. Specify, design, and implement computer-based systems.
c8. Apply the principles of human-computer interaction to the evaluation and construction of a wide range of materials including user interfaces, web pages, and multimedia systems.		C10	P5. Use an appropriate mix of tools and aids in preparing and presenting reports for a range of audiences, including management, technical, users or the academic community.	C8. Evaluate systems in terms of general quality attributes and possible tradeoffs presented within the given problem. C9. Apply the principles of effective information management, information organization, and information-retrieval skills to information of various kinds, including text, images, sound, and video.
c9. Identify any risks or safety aspects that may be involved in the operation of computing equipment within a given context.	P7	C11	P6. Commercialize knowledge and skills to computing community and industry.	C10. Apply the principles of human-computer interaction to the evaluation and construction of a wide range of materials including user interfaces, web pages, and multimedia systems.
c10. Deploy effectively the tools used for the construction and documentation of software, with particular emphasis on understanding the whole process involved in using computers to solve practical problems.	P3	C12	P7. Assess the implications, risks or safety aspects involved in the operation of computing equipment within a specific context.	C11. Identify any risks or safety aspects that may be involved in the operation of computing equipment within a given context. C12. Deploy effectively the tools used for the construction and documentation of software, with particular emphasis on understanding the whole process involved in using computers to solve practical problems.
c11. Make effective use of general computing facilities, plan and manage a project to complete within budget and schedule.	P1			C13. Prepare technical reports, and a dissertation, to a professional standard.
c12. Appreciate and manage the need for continuing professional development in recognition of the need for lifelong learning.		C3		
c13. Address and apply professional, moral and ethical issues within the discipline.	I9			
c14. Operate computing equipment efficiently, taking into account its logical and physical properties.	P1			
c15. Use investigative skills to research new and novel aspects of their work.	I10			
c16. Apply tools and techniques for the design and development of applications.	P2			

Academic Standards (Transferable Skills)

CS Program ILOs	Corresponding in NARS		NARS ILOs - General	NARS ILOs - Special
d1. Communicate effectively by oral, written and visual means.	T6	C2	T1. Demonstrate the ability to make use of a range of learning resources and to manage one's own learning.	−
d2. Work effectively as an individual and as a member of a team.	T2		T2. Demonstrate efficient skills in team management, time management and organizational skills.	
d3. Collaborate effectively within multidisciplinary team.	P4		T3. Show effective information-retrieval.	
d4. Work in stressful environment and within constraints.	T4		T4. Work in stressful environment and within constraints, cope with multiple tasks.	
d5. Prepare and present seminars to a professional standard.	P5	C4	T5. Exhibit appropriate numeracy skills in understanding and presenting cases involving a quantitative dimension.	
d6. Prepare technical reports, and a dissertation, to a professional standard; use IT skills and display mature computer literacy.		C6	T6. Exhibits communication skills, public speaking and Presentation skills, and delegation, writing skills, oral delivery, and effectively using various media for a variety of audiences.	
d7. Demonstrate efficient IT capabilities.	T3, T7		T7. Display effective use of general computing facilities.	
d8. Lead and motivate individuals.			T8. Develop a range of fundamental research skills, through the use of online resources, technical repositories and library-based material.	
d9. Manage tasks and resources.	T2		T9. Demonstrate an appreciation of the need to continue professional development in recognition of the requirement for Life Long Learning.	
d10. Search for information and adopt life-long self-learning.	T3, T9	C5		
d11. Acquire entrepreneurial skills.	P6			
d12. Manage one's own learning and development	T1, T9			
d13. Prepare their work in the form of reports	P5	C13		
d14. Communicate effectively with team members, managers and costumers.	T6	C2		

d15.	Exhibit appropriate numeracy skills in understanding and presenting cases involving a quantitative dimension.	T5		
d16.	Develop a range of fundamental research skills, through the use of online resources, technical repositories and library-based material.	T8		

Academic Standards Matrix

	Knowledge and Understanding Skills		
NARS ILOs General	Covering ILOs in CS Program	NARS ILOs Special	Covering ILOs in CS Program
K1	a7, a8, a9, a13, a14	A1	a1
K2	a13	A2	a2
K3	a17	A3	a3, a4
K4	a3, a4	A4	a5
K5	a6, a18	A5	a6
K6	a19	A6	a7
K7	a20	A7	a8, a9
K8	a15	A8	a10, a11, a12
K9	a16		

Intellectual Skills			
NARS ILOs General	Covering ILOs in CS Program	NARS ILOs Special	Covering ILOs in CS Program
I1	b14	B1	b1
I2	b15	B2	b2
I3	b12	B3	b3
I4	b16	B4	b4
I5	b13	B5	b5
I6	b17	B6	b6
I7	b18	B7	b7
I8	b12	B8	b8
I9	c13	B9	b9
I10	c15	B10	b10

Professional and Practical Skills			
NARS ILOs General	Covering ILOs in CS Program	NARS ILOs Special	Covering ILOs in CS Program
P1	c11, c14	**C1**	c1, c2, c3
P2	c5, c16	**C2**	d1, d14
P3	c10	**C3**	c4, c12
P4	d3		
P5	d5, d13	**C4**	d5
P6	d11	**C5**	d10
P7	c9	**C6**	d6
		C7	c5
		C8	c6
		C9	c7
		C10	c8
		C11	c9
		C12	c10
		C13	d13

Transferable skills	
NARS ILOs General	Covering ILOs in CS Program
T1	d12
T2	d2, d9
T3	d7, d10
T4	d4
T5	d15
T6	d1, d14
T7	d7
T8	d16
T9	d10, d12

CS Program Courses

	Course Code	Course Title		Course Code	Course Title
1st Level	CS141	Programming Fundamentals	**3rd Level**	CS311	Algorithm Design and Analysis
	IT101	IT Fundamentals		CS321	Operating Systems
	MATH101	Mathematics I		CS342	Automata and Language Theory
	MATH102	Mathematics II		CS351	Computer Graphics
	PHYS101	Physics I		CS352	Image Processing
	PHYS102	Physics II		CS361	Artificial Intelligence
	EE101	Electronics		CS381	Software Development and Professional Practice
	EE102	Digital Circuits		CS382	Field Training
	HUM111	English Language I		CS391	Software Engineering
	HUM121	Social Context of Computing		IT351	Computer Networks
	HUM132	Interpersonal Communication			
2nd Level	CS201	Discrete Structures	**4th Level**	CS431	Parallel Computation
	CS211	Data Structures and Algorithms		CS441	Compiler Construction
	CS241	Object-Oriented Programming		CS471	Introduction to Computer Security
	IS212	Databases		CS481	Capstone Project I
	IS221	Project Management		CS482	Capstone Project II
	IT251	Data Communications			
	CE221	Computer Architecture			
	MATH202	Probability and Statistics			
	HUM231	Business Administration			
	HUM232	Technical Writing			
	HUM241	Computers and Ethics			

Elective Courses					
	Course Code	Course Title		Course Code	Course Title
1st Level	HUM112	English Language II	**3rd Level**	CS301	Operation Research
	HUM122	Intellectual Property		CS302	Simulation and Modeling
	HUM131	Organizational Behavior		CS341	Visual Programming
	HUM133	Computing Economics		CS353	Advanced Computer Graphics
	HUM141	Computer Law		IT371	Web Programming
	HUM142	Privacy and Civil Liberties		MM301	Introduction to Multimedia Technology
	HUM151	Hand Drawing		MATH301	Numerical Analysis
	HUM152	History of Computing			
	HUM153	Islamic Culture			
	HUM154	Scientific Thinking			
2nd Level	IS201	Foundations of Information Systems	**4th Level**	CS421	Advanced Operating Systems
	IS211	File Organization		CS442	Programming Language Design
	IS231	Systems Analysis and Design		CS451	Computer Animation
	MATH201	Mathematics III		CS452	Computer Vision
	EE201	Digital Signal Processing		CS461	Intelligent Systems
				CS462	Machine Learning
				CS463	Pattern Recognition
				CS472	Cryptography
				CS491	Software Quality Assurance and Testing
				IS411	Advanced Database
				IS412	Distributed and Object Databases
				IS414	Data Mining and Business Intelligence
				IT431	Wireless and Mobile Computing
				IT432	Network Programming
				IT371	Web Programming
				MM411	Virtual Reality
				CE421	Advanced Computer Architecture
				CE422	Embedded Systems

Program Matrix I (Courses – NARS General)

Level	Course	K1	K2	K3	K4	K5	K6	K7	K8	K9	I1	I2	I3	I4	I5	I6	I7	I8	I9	I10	P1	P2	P3	P4	P5	P6	P7	T1	T2	T3	T4	T5	T6	T7	T8	T9
1st Level	CS141	✓		✓							✓	✓			✓						✓	✓						✓	✓		✓		✓			
	IT101	✓									✓																		✓			✓		✓		
	MATH101																					✓							✓				✓			
	MATH102																					✓														
	PHYS101										✓										✓					✓			✓				✓			
	PHYS102	✓							✓		✓						✓				✓			✓		✓			✓				✓			
	EE101																				✓					✓		✓	✓		✓		✓			✓
	EE102	✓																								✓		✓	✓				✓			✓
	HUM111										✓												✓	✓	✓			✓		✓			✓			✓
	HUM112										✓												✓	✓	✓			✓		✓			✓			
	HUM121							✓	✓														✓	✓	✓			✓		✓			✓			
	HUM122																						✓					✓	✓		✓		✓		✓	✓
	HUM131																									✓			✓		✓		✓			✓
	HUM132																						✓	✓	✓								✓		✓	
	HUM133			✓															✓							✓			✓			✓				
	HUM141							✓	✓															✓					✓		✓		✓			
	HUM142																												✓							
	HUM151																												✓							
	HUM152	✓																																✓		
	HUM153																							✓					✓							
	HUM154																												✓							
2nd Level	CS201	✓							✓															✓	✓			✓	✓		✓		✓	✓		
	CS211	✓					✓																	✓	✓			✓	✓		✓		✓	✓		
	CS241		✓										✓									✓						✓	✓		✓		✓	✓		
	IS201	✓					✓				✓			✓				✓				✓				✓	✓	✓	✓				✓	✓		
	IS211	✓																			✓	✓				✓	✓	✓	✓				✓			
	IS212	✓												✓				✓				✓	✓			✓		✓	✓				✓	✓		
	IS221			✓				✓	✓															✓	✓			✓	✓		✓		✓	✓		
	IS231	✓		✓			✓	✓	✓		✓			✓		✓		✓				✓		✓	✓		✓	✓	✓		✓		✓			✓
	IT251						✓							✓				✓				✓					✓	✓	✓		✓			✓		✓
	CE221	✓	✓			✓	✓							✓				✓			✓	✓					✓	✓	✓	✓	✓			✓		✓
	MATH201																					✓							✓		✓					
	MATH202																					✓							✓		✓					
	EE201																							✓					✓		✓					
	HUM231						✓	✓	✓	✓											✓					✓			✓		✓					
	HUM232						✓																✓		✓	✓		✓	✓		✓	✓	✓			
	HUM241						✓		✓	✓									✓							✓			✓		✓		✓			
3rd Level	CS301		✓	✓							✓	✓			✓											✓			✓	✓						
	CS302		✓																	✓															✓	✓
	CS311								✓													✓						✓		✓					✓	✓
	CS321	✓											✓		✓	✓						✓		✓	✓	✓		✓							✓	✓
	CS342				✓						✓											✓							✓		✓					
	CS341	✓	✓										✓	✓		✓		✓				✓	✓			✓			✓		✓					
	CS351																									✓			✓	✓			✓	✓		
	CS352								✓																	✓			✓	✓			✓	✓		
	CS353																									✓			✓	✓			✓	✓		
	CS361																					✓				✓			✓	✓			✓	✓		
	CS381	✓		✓				✓				✓		✓		✓	✓									✓	✓		✓		✓					
	CS382																				✓	✓				✓			✓		✓					
	CS391	✓	✓	✓			✓	✓	✓		✓	✓	✓					✓	✓			✓					✓	✓	✓	✓			✓			✓
	IT351				✓		✓														✓					✓	✓	✓	✓	✓	✓		✓	✓		✓

Level	Course	K1	K2	K3	K4	K5	K6	K7	K8	K9	I1	I2	I3	I4	I5	I6	I7	I8	I9	I10	P1	P2	P3	P4	P5	P6	P7	T1	T2	T3	T4	T5	T6	T7	T8	T9
	IT371	✓																										✓	✓			✓				
	MM301		✓			✓						✓				✓							✓	✓	✓				✓		✓	✓	✓		✓	
	MATH301																					✓							✓					✓		
4th Level	CS421			✓										✓										✓			✓	✓	✓	✓		✓	✓			
	CS431	✓	✓																			✓							✓			✓				
	CS441											✓											✓						✓			✓				
	CS442			✓								✓										✓			✓			✓	✓			✓	✓			
	CS451																												✓							✓
	CS452	✓																										✓	✓			✓				
	CS461																					✓			✓			✓	✓			✓	✓			
	CS462							✓											✓				✓						✓							
	CS463	✓																										✓	✓			✓				
	CS471			✓										✓												✓		✓		✓		✓				
	CS472	✓									✓	✓										✓		✓					✓				✓	✓		
	CS481	✓							✓							✓	✓		✓	✓	✓	✓	✓	✓			✓		✓		✓		✓			✓
	CS482	✓							✓							✓	✓		✓	✓	✓	✓	✓	✓			✓		✓		✓		✓			✓
	CS491	✓							✓															✓	✓			✓	✓	✓		✓	✓			
	IS411	✓													✓			✓				✓	✓			✓		✓	✓			✓	✓			
	IS412								✓											✓			✓						✓			✓				
	IS414								✓											✓			✓						✓			✓				
	IT431			✓				✓				✓											✓						✓			✓			✓	
	IT432	✓																										✓	✓			✓				
	IT371	✓																										✓	✓			✓				
	MM411	✓																										✓	✓			✓				
	CE421																				✓						✓	✓	✓			✓			✓	
	CE422						✓							✓			✓						✓			✓			✓							✓

Program Matrix II (Courses – NARS Special)

Level	Course	A1	A2	A3	A4	A5	A6	A7	A8	B1	B2	B3	B4	B5	B6	B7	B8	B9	B10	C1	C2	C3	C4	C5	C6	C7	C8	C9	C10	C11	C12	C13
1st Level	CS141	✓	✓	✓	✓	✓	✓		✓	✓	✓	✓	✓	✓						✓	✓		✓									
	IT101	✓	✓	✓	✓	✓		✓		✓	✓	✓								✓	✓	✓										
	MATH101	✓	✓							✓					✓					✓	✓											
	MATH102	✓	✓	✓	✓					✓	✓	✓	✓	✓	✓					✓	✓	✓										
	PHYS101	✓	✓	✓	✓	✓				✓	✓	✓	✓							✓	✓	✓	✓		✓	✓	✓	✓				
	PHYS102	✓	✓	✓	✓		✓			✓	✓	✓	✓							✓	✓	✓	✓		✓	✓						
	EE101	✓	✓	✓	✓					✓	✓	✓	✓	✓						✓	✓	✓	✓		✓	✓						
	EE102	✓	✓	✓	✓	✓	✓	✓		✓		✓	✓	✓	✓	✓	✓			✓	✓	✓	✓		✓	✓						
	HUM111			✓											✓						✓	✓		✓	✓	✓					✓	✓
	HUM112	✓	✓							✓	✓	✓								✓	✓		✓		✓							
	HUM121	✓	✓							✓										✓	✓											
	HUM122	✓	✓							✓	✓	✓								✓	✓											
	HUM131	✓	✓							✓	✓	✓								✓	✓		✓		✓							
	HUM132	✓	✓	✓	✓					✓	✓	✓	✓							✓	✓	✓				✓						
	HUM133	✓	✓							✓	✓									✓	✓											
	HUM141	✓	✓							✓	✓									✓	✓		✓		✓							
	HUM142	✓	✓	✓	✓	✓				✓	✓	✓	✓							✓	✓											
	HUM151			✓	✓	✓	✓	✓		✓	✓	✓								✓	✓											
	HUM152		✓	✓	✓		✓			✓		✓								✓	✓	✓										
	HUM153	✓	✓							✓	✓									✓	✓											
	HUM154	✓	✓	✓	✓					✓	✓	✓	✓	✓						✓	✓											
2nd Level	CS201	✓	✓							✓	✓	✓	✓	✓	✓					✓	✓	✓										
	CS211	✓	✓	✓	✓					✓	✓								✓	✓	✓	✓	✓		✓	✓	✓					
	CS241	✓	✓	✓						✓	✓	✓	✓	✓						✓	✓	✓	✓		✓	✓						
	IS201	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		✓	✓	✓		✓			
	IS211		✓				✓				✓		✓				✓			✓	✓				✓		✓					
	IS212	✓	✓	✓	✓	✓	✓			✓	✓	✓	✓	✓						✓	✓	✓	✓		✓	✓	✓					
	IS221	✓	✓							✓	✓									✓	✓		✓		✓							
	IS231		✓	✓	✓	✓		✓	✓	✓			✓	✓	✓	✓	✓			✓			✓	✓	✓	✓				✓		✓
	IT251	✓	✓	✓		✓	✓			✓	✓	✓	✓	✓	✓					✓	✓	✓	✓		✓	✓						
	CE221	✓	✓	✓	✓	✓	✓	✓		✓	✓	✓	✓	✓						✓	✓											
	MATH201														✓		✓				✓											
	MATH202	✓	✓	✓	✓					✓	✓	✓	✓	✓	✓					✓	✓	✓										
	EE201	✓	✓	✓						✓	✓	✓	✓	✓							✓	✓										
	HUM231	✓	✓							✓	✓	✓								✓	✓		✓		✓							
	HUM232	✓	✓	✓						✓	✓	✓								✓	✓		✓		✓							
	HUM241	✓	✓							✓	✓	✓								✓	✓		✓		✓							
3rd Level	CS301	✓	✓	✓	✓	✓	✓	✓		✓	✓	✓	✓							✓	✓		✓									
	CS302	✓	✓	✓	✓	✓	✓	✓		✓	✓	✓	✓							✓	✓		✓									
	CS311	✓	✓	✓	✓					✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		✓	✓	✓	✓				
	CS321	✓	✓	✓	✓		✓			✓	✓	✓	✓							✓	✓	✓				✓						
	CS342	✓	✓	✓	✓					✓	✓	✓	✓	✓						✓	✓	✓	✓			✓						
	CS341	✓	✓	✓	✓	✓				✓	✓	✓	✓	✓						✓	✓	✓	✓		✓	✓						
	CS351														✓	✓																
	CS352	✓	✓	✓	✓	✓	✓	✓		✓	✓	✓	✓	✓						✓	✓	✓	✓		✓	✓						
	CS353	✓	✓	✓	✓	✓	✓			✓		✓		✓			✓			✓		✓										
	CS361	✓	✓	✓	✓	✓	✓			✓	✓	✓	✓	✓	✓		✓			✓	✓	✓	✓		✓	✓	✓					
	CS381	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		✓	✓	✓					
	CS382	✓	✓	✓	✓	✓	✓	✓		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		✓	✓	✓			✓	✓	
	CS391	✓	✓	✓	✓		✓	✓	✓	✓		✓		✓			✓	✓	✓	✓	✓	✓	✓		✓	✓	✓					

	A1	A2	A3	A4	A5	A6	A7	A8	B1	B2	B3	B4	B5	B6	B7	B8	B9	B10	C1	C2	C3	C4	C5	C6	C7	C8	C9	C10	C11	C12	C13
IT351	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		✓	✓	✓				
IT371	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓									✓	✓		✓		✓	✓					
MATH301	✓	✓	✓							✓	✓	✓	✓	✓	✓					✓	✓	✓	✓		✓	✓	✓	✓			
CS421	✓	✓	✓							✓	✓	✓	✓	✓						✓	✓	✓	✓		✓	✓					
CS431	✓	✓	✓	✓	✓	✓	✓			✓	✓	✓	✓	✓						✓	✓	✓									
CS441	✓	✓	✓	✓	✓						✓	✓	✓	✓						✓	✓	✓									
CS442	✓	✓	✓	✓	✓					✓	✓	✓	✓	✓						✓	✓	✓	✓		✓	✓	✓				
CS451	✓	✓	✓	✓						✓	✓	✓								✓	✓	✓				✓	✓				
CS452	✓	✓	✓							✓	✓	✓	✓							✓	✓	✓	✓								
CS461	✓	✓	✓							✓	✓	✓								✓	✓	✓			✓	✓					
CS462	✓	✓	✓							✓	✓	✓								✓	✓	✓			✓	✓					
CS463	✓	✓	✓							✓	✓	✓								✓	✓	✓			✓	✓					
CS471	✓	✓	✓	✓	✓	✓	✓			✓	✓	✓	✓	✓						✓	✓	✓				✓	✓				
CS472	✓	✓	✓	✓	✓	✓	✓	✓		✓	✓	✓	✓	✓						✓	✓	✓	✓		✓	✓					
CS481	✓	✓	✓	✓	✓	✓	✓			✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		✓	✓	✓	✓	✓		
CS482	✓	✓	✓	✓	✓	✓	✓			✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		✓	✓	✓	✓	✓		
CS491	✓	✓	✓							✓	✓	✓	✓	✓						✓	✓		✓		✓						
IS411	✓	✓	✓							✓	✓	✓	✓	✓						✓	✓		✓		✓						
IS412	✓	✓	✓	✓	✓					✓	✓	✓	✓	✓	✓	✓	✓			✓	✓	✓	✓		✓	✓					
IS414	✓	✓	✓	✓	✓	✓	✓			✓	✓	✓	✓	✓						✓	✓	✓	✓		✓	✓					
IT431	✓	✓	✓	✓	✓					✓	✓	✓	✓	✓						✓	✓	✓	✓		✓	✓					
IT432	✓	✓	✓	✓	✓	✓	✓			✓	✓	✓								✓	✓	✓	✓		✓	✓					
MM411	✓	✓	✓	✓	✓					✓	✓	✓	✓	✓						✓	✓										
CE421	✓	✓	✓	✓	✓		✓			✓	✓	✓	✓	✓						✓	✓	✓				✓					
CE422	✓	✓	✓	✓	✓	✓	✓	✓		✓	✓	✓	✓	✓	✓					✓	✓	✓	✓		✓	✓					

(Row group label: 4th Level)

Program Matrix III (Courses - Knowledge and Understanding Skills)

	Code	Course	a1	a2	a3	a4	a5	a6	a7	a8	a9	a10	a11	a12	a13	a14	a15	a16	a17	a18	a19	a20
1st Level	CS141	Programming Fundamentals	✓	✓	✓	✓	✓	✓	✓				✓	✓	✓	✓						
	IT101	IT Fundamentals	✓	✓	✓	✓	✓	✓		✓	✓											
	MATH101	Mathematics I	✓	✓																		
	MATH102	Mathematics II	✓	✓	✓	✓	✓															
	PHYS101	Physics I	✓	✓	✓	✓	✓	✓														
	PHYS102	Physics II	✓	✓	✓	✓	✓		✓													
	EE101	Electronics	✓	✓	✓	✓	✓															
	EE102	Digital Circuits	✓	✓	✓	✓	✓	✓	✓	✓												
	HUM111	English Language I																				
	HUM121	Social Context of Computing	✓	✓													✓	✓				
	HUM132	Interpersonal Communication	✓	✓	✓	✓	✓															
2nd Level	CS201	Discrete Structures	✓	✓																		
	CS211	Data Structures and Algorithms	✓	✓	✓	✓	✓															
	CS241	Object-Oriented Programming	✓	✓	✓	✓																
	IS212	Databases	✓	✓	✓	✓	✓	✓	✓													
	IS221	Project Management	✓	✓													✓	✓	✓			✓
	IT251	Data Communications	✓	✓	✓	✓		✓	✓												✓	
	CE221	Computer Architecture	✓	✓	✓	✓	✓	✓	✓	✓										✓	✓	
	MATH202	Probability and Statistics	✓	✓	✓	✓	✓															
	HUM231	Business Administration	✓	✓													✓	✓				
	HUM232	Technical Writing	✓	✓	✓																	
	HUM241	Computers and Ethics	✓	✓													✓	✓				
3rd Level	CS311	Algorithm Design and Analysis	✓	✓	✓	✓	✓															
	CS321	Operating Systems	✓	✓	✓	✓	✓	✓	✓	✓												
	CS342	Automata and Language Theory	✓	✓	✓	✓	✓													✓		
	CS351	Computer Graphics	✓	✓	✓	✓	✓	✓	✓													
	CS352	Image Processing	✓	✓	✓	✓	✓	✓	✓	✓												
	CS361	Artificial Intelligence	✓	✓	✓	✓	✓	✓														
	CS381	Software Development and Professional Practice	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓										
	CS382	Field Training	✓	✓	✓	✓	✓	✓	✓	✓												
	CS391	Software Engineering	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓							✓			✓
	IT351	Computer Networks	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓									✓	
4th Level	CS431	Parallel Computation	✓	✓	✓	✓	✓	✓	✓	✓	✓											
	CS441	Compiler Construction	✓	✓	✓	✓	✓	✓														
	CS471	Introduction to Computer Security	✓	✓	✓	✓	✓	✓	✓	✓												
	CS481	Capstone Project I	✓	✓	✓	✓	✓	✓	✓	✓												
	CS482	Capstone Project II	✓	✓	✓	✓	✓	✓	✓	✓												

Program Matrix IV (Courses - Intellectual Skills)

	Code	Course	b1	b2	b3	b4	b5	b6	b7	b8	b9	b10	b11	b12	b13	b14	b15	b16	b17	b18
1st Level	CS141	Programming Fundamentals	✓	✓	✓	✓	✓													
	IT101	IT Fundamentals	✓	✓	✓															
	MATH101	Mathematics I	✓					✓												
	MATH102	Mathematics II	✓	✓	✓	✓	✓	✓												
	PHYS101	Physics I	✓	✓	✓	✓														
	PHYS102	Physics II	✓	✓	✓	✓														
	EE101	Electronics	✓	✓	✓	✓	✓	✓												
	EE102	Digital Circuits	✓		✓	✓	✓	✓	✓	✓										
	HUM111	English Language I				✓										✓				
	HUM121	Social Context of Computing	✓	✓																
	HUM132	Interpersonal Communication	✓	✓	✓	✓														
2nd Level	CS201	Discrete Structures	✓	✓	✓	✓	✓	✓												
	CS211	Data Structures and Algorithms	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓						
	CS241	Object-Oriented Programming	✓	✓	✓	✓	✓													
	IS212	Databases	✓	✓	✓	✓	✓													
	IS221	Project Management	✓	✓																
	IT251	Data Communications		✓	✓	✓	✓	✓												
	CE221	Computer Architecture	✓	✓	✓	✓	✓													
	MATH202	Probability and Statistics	✓	✓	✓	✓	✓	✓												
	HUM231	Business Administration	✓	✓	✓															
	HUM232	Technical Writing	✓	✓	✓															
	HUM241	Computers and Ethics	✓	✓	✓															
3rd Level	CS311	Algorithm Design and Analysis		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓							
	CS321	Operating Systems	✓	✓	✓	✓	✓													
	CS342	Automata and Language Theory	✓	✓	✓	✓	✓													
	CS351	Computer Graphics	✓	✓	✓		✓	✓		✓										
	CS352	Image Processing	✓	✓	✓	✓	✓	✓												
	CS361	Artificial Intelligence	✓	✓	✓	✓	✓	✓	✓	✓										
	CS381	Software Development and Professional Practice	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓			
	CS382	Field Training	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓								
	CS391	Software Engineering	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
	IT351	Computer Networks	✓	✓	✓	✓	✓													
4th Level	CS431	Parallel Computation	✓	✓	✓	✓	✓													
	CS441	Compiler Construction			✓	✓	✓	✓												
	CS471	Introduction to Computer Security		✓	✓	✓	✓	✓												
	CS481	Capstone Project I	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓								
	CS482	Capstone Project II	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓								

Program MatrixV (Courses - Professional and Practical Skills)

	Code	Course	c1	c2	c3	c4	c5	c6	c7	c8	c9	c10	c11	c12	c13	c14	c15	C16
1st Level	CS141	Programming Fundamentals	✓	✓	✓													
	IT101	IT Fundamentals	✓	✓	✓	✓												
	MATH101	Mathematics I	✓	✓	✓													
	MATH102	Mathematics II	✓	✓	✓	✓												
	PHYS101	Physics I	✓	✓	✓	✓	✓	✓										
	PHYS102	Physics II	✓	✓	✓	✓	✓											
	EE101	Electronics	✓	✓	✓	✓	✓											
	EE102	Digital Circuits	✓	✓	✓	✓	✓	✓										
	HUM111	English Language I				✓							✓		✓			
	HUM121	Social Context of Computing	✓	✓												✓		
	HUM132	Interpersonal Communication	✓	✓	✓	✓	✓											
2nd Level	CS201	Discrete Structures	✓	✓	✓	✓												
	CS211	Data Structures and Algorithms	✓	✓	✓	✓	✓	✓										
	CS241	Object-Oriented Programming	✓	✓														
	IS212	Databases	✓	✓	✓	✓	✓	✓										
	IS221	Project Management	✓									✓		✓				
	IT251	Data Communications	✓	✓	✓	✓	✓											
	CE221	Computer Architecture	✓	✓	✓													
	MATH202	Probability and Statistics	✓	✓	✓	✓												
	HUM231	Business Administration	✓	✓	✓											✓		
	HUM232	Technical Writing	✓	✓	✓													
	HUM241	Computers and Ethics	✓	✓	✓											✓		
3rd Level	CS311	Algorithm Design and Analysis	✓	✓	✓	✓	✓	✓	✓							✓	✓	✓
	CS321	Operating Systems	✓	✓	✓	✓	✓											
	CS342	Automata and Language Theory	✓	✓	✓	✓	✓											
	CS351	Computer Graphics	✓	✓	✓	✓												
	CS352	Image Processing	✓	✓	✓	✓	✓											
	CS361	Artificial Intelligence	✓	✓	✓	✓	✓	✓										
	CS381	Software Development and Professional Practice	✓	✓	✓	✓	✓	✓										
	CS382	Field Training	✓	✓	✓	✓	✓	✓	✓	✓								
	CS391	Software Engineering	✓	✓	✓	✓	✓	✓										
	IT351	Computer Networks	✓	✓	✓	✓	✓	✓	✓									
4th Level	CS431	Parallel Computation	✓	✓	✓	✓												
	CS441	Compiler Construction	✓	✓	✓	✓												
	CS471	Introduction to Computer Security			✓	✓		✓	✓									
	CS481	Capstone Project I	✓	✓	✓	✓	✓	✓	✓	✓								
	CS482	Capstone Project II	✓	✓	✓	✓	✓	✓	✓	✓								

Program Matrix VI (Courses - Transferable Skills)

	Code	Course	d1	d2	d3	d4	d5	d6	d7	d8	d9	d10	d11	d12	d13	d14	d15	d16
1st Level	CS141	Programming Fundamentals	✓	✓	✓	✓	✓											
	IT101	IT Fundamentals	✓	✓	✓	✓												
	MATH101	Mathematics I	✓	✓	✓													
	MATH102	Mathematics II	✓	✓	✓													
	PHYS101	Physics I	✓	✓	✓	✓	✓	✓										
	PHYS102	Physics II	✓	✓	✓	✓	✓	✓										
	EE101	Electronics	✓	✓	✓	✓	✓	✓										
	EE102	Digital Circuits	✓	✓	✓	✓	✓	✓										
	HUM111	English Language I	✓		✓			✓				✓		✓	✓			
	HUM121	Social Context of Computing	✓	✓	✓	✓												
	HUM132	Interpersonal Communication	✓	✓														
2nd Level	CS201	Discrete Structures	✓	✓	✓	✓												
	CS211	Data Structures and Algorithms	✓	✓	✓	✓	✓	✓										
	CS241	Object-Oriented Programming	✓	✓	✓	✓	✓	✓										
	IS212	Databases	✓		✓	✓	✓		✓									
	IS221	Project Management	✓	✓	✓	✓	✓	✓					✓					
	IT251	Data Communications	✓	✓	✓	✓	✓	✓										
	CE221	Computer Architecture	✓	✓	✓	✓												
	MATH202	Probability and Statistics	✓	✓	✓													
	HUM231	Business Administration	✓	✓	✓	✓	✓	✓	✓									
	HUM232	Technical Writing	✓	✓	✓	✓	✓	✓	✓	✓	✓							
	HUM241	Computers and Ethics	✓	✓	✓	✓	✓	✓	✓	✓	✓							
3rd Level	CS311	Algorithm Design and Analysis	✓	✓	✓	✓	✓	✓										
	CS321	Operating Systems	✓	✓														
	CS342	Automata and Language Theory	✓	✓	✓		✓											
	CS351	Computer Graphics	✓	✓	✓	✓	✓	✓	✓									
	CS352	Image Processing	✓	✓	✓	✓	✓	✓										
	CS361	Artificial Intelligence	✓	✓	✓	✓	✓	✓	✓	✓								
	CS381	Software Development and Professional Practice	✓	✓	✓	✓	✓	✓										
	CS382	Field Training	✓	✓	✓	✓	✓	✓										
	CS391	Software Engineering	✓	✓	✓	✓	✓	✓								✓	✓	✓
	IT351	Computer Networks	✓	✓	✓	✓	✓	✓	✓	✓	✓							
4th Level	CS431	Parallel Computation	✓	✓	✓	✓												
	CS441	Compiler Construction	✓	✓	✓	✓												
	CS471	Introduction to Computer Security	✓	✓	✓	✓												
	CS481	Capstone Project I	✓	✓	✓	✓	✓	✓										
	CS482	Capstone Project II	✓	✓	✓	✓	✓	✓										

Program Matrix (Courses – CS Program)

	a1	a2	a3	a4	a5	a6	a7	a8	a9	a10	a11	a12	a13	a14	a15	a16	a17	a18	a19	a20	b1	b2	b3	b4	b5	b6	b7	b8	b9	b10	b11	b12	b13	b14	b15	b16	b17	b18
1st Level																																						
CS141	✓	✓	✓	✓	✓	✓	✓				✓	✓	✓	✓							✓	✓	✓	✓	✓													
IT101	✓	✓	✓	✓	✓	✓		✓	✓												✓	✓	✓															
MATH10	✓	✓																			✓					✓												
MATH10	✓	✓	✓	✓	✓																✓	✓	✓	✓	✓	✓												
PHYS101	✓	✓	✓	✓	✓	✓															✓	✓	✓	✓														
PHYS102	✓	✓	✓	✓	✓		✓														✓	✓	✓	✓														
EE101	✓	✓	✓	✓	✓																✓	✓	✓	✓														
EE102	✓	✓	✓	✓	✓	✓	✓	✓													✓		✓	✓	✓	✓	✓	✓										
HUM111																							✓											✓				
HUM112	✓	✓																			✓	✓	✓															
HUM121	✓	✓													✓	✓					✓	✓																
HUM122	✓	✓																			✓	✓																
HUM131	✓	✓																			✓	✓	✓															
HUM132	✓	✓	✓	✓	✓																✓	✓	✓															
HUM133	✓	✓																			✓																	
HUM141	✓	✓													✓	✓					✓	✓																
HUM142	✓	✓	✓	✓	✓																✓	✓	✓	✓														
HUM151					✓								✓	✓							✓	✓	✓															
HUM152		✓		✓	✓				✓												✓	✓	✓															
HUM153	✓	✓																			✓	✓																
HUM154	✓	✓	✓	✓																	✓	✓	✓	✓	✓													
2nd Level																																						
CS201	✓	✓																			✓	✓	✓	✓	✓	✓												
CS211	✓	✓	✓	✓	✓																✓	✓											✓	✓				
CS241	✓	✓	✓	✓																	✓	✓	✓	✓	✓													
IS201	✓	✓	✓	✓	✓	✓	✓	✓	✓												✓	✓	✓	✓	✓	✓	✓	✓	✓	✓								
IS211		✓					✓															✓		✓				✓										
IS212	✓	✓	✓	✓	✓	✓	✓														✓	✓	✓	✓	✓													
IS221	✓	✓															✓			✓	✓	✓																
IS231			✓		✓				✓		✓		✓		✓		✓			✓	✓	✓	✓	✓	✓	✓	✓					✓		✓				✓
IT251	✓	✓	✓	✓		✓	✓												✓		✓	✓	✓	✓	✓													
CE221	✓	✓	✓	✓	✓	✓	✓	✓										✓	✓		✓	✓	✓	✓	✓													
MATH20																															✓		✓					
MATH20	✓	✓			✓																✓	✓	✓	✓	✓	✓												
EE201	✓	✓	✓																		✓	✓	✓	✓	✓													
HUM231	✓	✓													✓	✓					✓	✓	✓															
HUM232	✓	✓	✓																		✓	✓	✓															
HUM241	✓	✓													✓	✓					✓	✓	✓															
3rd Level																																						
CS301	✓	✓	✓	✓	✓	✓	✓		✓												✓	✓	✓	✓														
CS302	✓	✓	✓	✓	✓	✓	✓	✓	✓												✓	✓	✓															
CS311	✓	✓	✓	✓	✓																✓	✓	✓	✓	✓	✓	✓	✓	✓	✓								
CS321	✓	✓	✓		✓	✓	✓	✓													✓	✓	✓	✓														
CS342	✓	✓	✓	✓	✓													✓			✓	✓	✓	✓														
CS341	✓	✓	✓	✓	✓	✓															✓	✓	✓	✓														
CS351	✓	✓	✓	✓	✓	✓	✓														✓		✓	✓	✓	✓												
CS352	✓	✓	✓	✓	✓	✓	✓														✓	✓	✓	✓	✓													
CS353	✓	✓	✓	✓	✓	✓	✓														✓		✓		✓	✓												
CS361	✓	✓	✓	✓	✓	✓	✓														✓	✓	✓	✓	✓	✓	✓	✓										
CS381	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓											✓	✓	✓	✓	✓	✓	✓	✓		✓	✓	✓	✓	✓	✓			

4th Level

Course	a1	a2	a3	a4	a5	a6	a7	a8	a9	a10	a11	a12	a13	a14	a15	a16	a17	a18	a19	a20	b1	b2	b3	b4	b5	b6	b7	b8	b9	b10	b11	b12	b13	b14	b15	b16	b17	b18
CS382	✓	✓	✓	✓	✓	✓	✓	✓													✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓							
CS391	✓	✓	✓	✓	✓	✓		✓	✓								✓			✓	✓	✓	✓				✓		✓				✓		✓	✓	✓	✓
IT351	✓	✓	✓	✓	✓	✓	✓	✓	✓										✓		✓	✓	✓	✓	✓	✓	✓	✓	✓			✓	✓	✓	✓	✓		
IT371	✓	✓	✓	✓	✓		✓	✓													✓	✓	✓															
MM301	✓		✓								✓					✓				✓	✓							✓	✓						✓		✓	✓
MATH30	✓	✓	✓																		✓	✓	✓	✓	✓	✓												
CS421	✓	✓	✓	✓																	✓	✓	✓	✓	✓													
CS431	✓	✓	✓	✓	✓	✓	✓	✓	✓												✓	✓	✓	✓	✓													
CS441	✓	✓	✓	✓	✓	✓																	✓	✓	✓	✓												
CS442	✓	✓	✓	✓	✓	✓															✓	✓	✓	✓														
CS451	✓	✓	✓	✓	✓																✓	✓	✓	✓														
CS452	✓	✓	✓																		✓	✓	✓	✓														
CS461	✓	✓	✓	✓																	✓	✓	✓															
CS462	✓	✓	✓	✓																	✓	✓	✓															
CS463	✓	✓	✓																		✓	✓	✓															
CS471	✓	✓	✓	✓	✓	✓	✓	✓													✓	✓	✓	✓	✓	✓												
CS472	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓											✓	✓	✓	✓	✓	✓												
CS481	✓	✓	✓	✓	✓	✓	✓	✓													✓	✓	✓	✓	✓	✓	✓	✓	✓									
CS482	✓	✓	✓	✓	✓	✓	✓	✓													✓	✓	✓	✓	✓	✓	✓	✓	✓									
CS491	✓	✓	✓	✓																	✓	✓	✓	✓	✓											✓	✓	✓
IS411	✓	✓	✓	✓																	✓	✓	✓	✓	✓	✓	✓											
IS412	✓	✓	✓	✓	✓																✓	✓	✓	✓	✓	✓	✓	✓										
IS414	✓	✓	✓	✓	✓	✓	✓	✓													✓	✓	✓	✓	✓	✓	✓											
IT431	✓	✓	✓	✓	✓	✓															✓	✓	✓	✓	✓	✓												
IT432	✓	✓	✓	✓	✓	✓	✓	✓													✓	✓	✓															
IT371											✓	✓	✓				✓	✓	✓	✓											✓	✓		✓			✓	✓
MM411	✓	✓	✓	✓	✓	✓															✓	✓	✓	✓	✓													
CE421	✓	✓	✓	✓	✓	✓		✓													✓	✓	✓	✓	✓													
CE422	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓											✓	✓	✓	✓	✓	✓												

1st Level

Course	c1	c2	c3	c4	c5	c6	c7	c8	c9	c10	c11	c12	c13	c14	c15	c16	d1	d2	d3	d4	d5	d6	d7	d8	d9	d10	d11	d12	d13	d14	d15	d16
CS141	✓	✓	✓														✓	✓	✓	✓	✓											
IT101	✓	✓	✓	✓													✓	✓	✓	✓												
MATH101	✓	✓	✓														✓	✓	✓													
MATH102	✓	✓	✓	✓													✓	✓	✓													
PHYS101	✓	✓	✓	✓	✓	✓											✓	✓	✓	✓	✓	✓										
PHYS102	✓	✓	✓	✓	✓												✓	✓	✓	✓	✓	✓										
EE101	✓	✓	✓	✓	✓												✓	✓	✓	✓	✓											
EE102	✓	✓	✓	✓	✓	✓											✓	✓	✓	✓	✓											
HUM111				✓						✓		✓					✓		✓				✓			✓			✓	✓		
HUM112	✓	✓	✓														✓	✓	✓	✓	✓	✓	✓									
HUM121	✓	✓											✓				✓	✓	✓	✓												
HUM122	✓	✓	✓														✓	✓	✓	✓	✓	✓	✓									
HUM131	✓	✓	✓														✓	✓	✓	✓	✓	✓	✓									
HUM132	✓	✓	✓	✓	✓												✓	✓														
HUM133	✓	✓															✓	✓														
HUM141	✓	✓											✓				✓	✓	✓	✓	✓	✓	✓									
HUM142		✓	✓														✓	✓	✓													
HUM151	✓	✓															✓	✓	✓	✓												
HUM152		✓	✓	✓													✓	✓	✓													

Course learning outcome mapping matrix. Two checkmark groups (Group A = columns A1–A15, Group B = columns B1–B15).

Level	Course	A1	A2	A3	A4	A5	A6	A7	A8	A9	A10	A11	A12	A13	A14	A15	B1	B2	B3	B4	B5	B6	B7	B8	B9	B10	B11	B12	B13	B14	B15
	HUM153	✓	✓														✓	✓													
	HUM154	✓	✓														✓	✓	✓	✓											
2nd Level	CS201	✓	✓	✓	✓												✓	✓	✓	✓											
	CS211	✓	✓	✓	✓	✓	✓										✓	✓	✓	✓	✓	✓									
	CS241	✓	✓														✓	✓	✓	✓	✓	✓	✓								
	IS201	✓	✓	✓	✓	✓	✓		✓								✓		✓	✓	✓	✓	✓								
	IS211	✓				✓		✓		✓				✓			✓		✓	✓	✓						✓	✓		✓	
	IS212	✓	✓	✓	✓	✓	✓										✓		✓	✓	✓	✓									
	IS221	✓							✓		✓						✓	✓	✓	✓	✓	✓	✓				✓			✓	✓
	IS231				✓	✓			✓									✓	✓	✓		✓		✓	✓	✓				✓	✓
	IT251	✓	✓		✓	✓											✓	✓	✓	✓	✓	✓									
	CE221	✓	✓	✓													✓	✓	✓	✓											
	MATH201														✓		✓	✓	✓												
	MATH202	✓	✓	✓	✓												✓	✓	✓	✓											
	EE201			✓													✓	✓	✓	✓											
	HUM231	✓	✓	✓									✓				✓	✓	✓	✓	✓	✓	✓	✓							
	HUM232	✓	✓	✓													✓	✓	✓	✓	✓	✓	✓	✓	✓						
	HUM241	✓	✓	✓									✓				✓	✓	✓	✓	✓	✓	✓	✓	✓	✓					
3rd Level	CS301	✓	✓	✓													✓	✓	✓	✓	✓										
	CS302	✓	✓	✓													✓	✓	✓	✓	✓										
	CS311	✓	✓	✓	✓	✓	✓	✓				✓	✓	✓			✓	✓	✓	✓	✓	✓	✓								
	CS321	✓	✓	✓	✓	✓											✓	✓													
	CS342	✓	✓	✓	✓	✓											✓	✓	✓		✓										
	CS341	✓	✓	✓	✓	✓											✓	✓	✓	✓	✓	✓									
	CS351	✓	✓	✓	✓												✓	✓	✓	✓	✓	✓		✓							
	CS352	✓	✓	✓	✓	✓											✓	✓	✓	✓	✓	✓									
	CS353	✓	✓	✓	✓																			✓							
	CS361	✓	✓	✓	✓	✓											✓	✓	✓	✓	✓	✓	✓	✓							
	CS381	✓	✓	✓	✓	✓											✓	✓	✓	✓	✓	✓									
	CS382	✓	✓	✓	✓	✓	✓	✓									✓	✓	✓	✓	✓	✓									
	CS391	✓	✓	✓	✓	✓	✓										✓	✓	✓	✓	✓	✓							✓	✓	✓
	IT351	✓	✓	✓	✓	✓	✓										✓	✓	✓	✓	✓	✓									
	IT371	✓	✓	✓	✓	✓											✓	✓	✓	✓	✓	✓	✓								
	MM301	✓						✓		✓		✓					✓	✓	✓	✓	✓	✓							✓	✓	✓
	MATH301	✓	✓	✓	✓	✓	✓	✓									✓	✓	✓	✓	✓	✓	✓	✓							
4th Level	CS421		✓	✓	✓	✓											✓	✓	✓	✓	✓	✓	✓								
	CS431	✓	✓	✓	✓												✓	✓	✓	✓											
	CS441	✓	✓	✓	✓												✓	✓	✓	✓											
	CS442	✓	✓	✓	✓	✓	✓										✓	✓	✓	✓	✓	✓	✓								
	CS451	✓	✓	✓	✓	✓	✓										✓	✓	✓	✓											
	CS452	✓	✓	✓													✓	✓	✓	✓	✓										
	CS461	✓	✓	✓	✓	✓	✓										✓	✓	✓	✓											
	CS462	✓	✓	✓	✓	✓	✓										✓	✓	✓	✓											
	CS463	✓	✓	✓	✓	✓	✓										✓	✓	✓	✓											
	CS471		✓	✓		✓	✓										✓	✓	✓	✓											
	CS472	✓	✓	✓	✓	✓											✓	✓	✓	✓	✓	✓	✓								
	CS481	✓	✓	✓	✓	✓	✓	✓	✓								✓	✓	✓	✓	✓	✓	✓	✓	✓	✓					
	CS482	✓	✓	✓	✓	✓	✓	✓	✓								✓	✓	✓	✓	✓	✓	✓	✓	✓	✓					
	CS491	✓	✓														✓	✓	✓	✓	✓	✓									
	IS411	✓	✓														✓	✓	✓	✓	✓	✓									
	IS412	✓	✓	✓	✓	✓	✓										✓	✓	✓	✓	✓										
	IS414	✓	✓	✓	✓	✓											✓	✓	✓	✓	✓	✓	✓								
	IT431	✓	✓	✓	✓	✓											✓	✓	✓	✓	✓	✓									
	IT432	✓	✓	✓	✓	✓											✓	✓	✓	✓	✓	✓	✓								
	IT371	✓	✓			✓		✓	✓																		✓	✓	✓	✓	✓

	c1	c2	c3	c4	c5	c6	c7	c8	c9	c10	c11	c12	c13	c14	c15	c16	d1	d2	d3	d4	d5	d6	d7	d8	d9	d10	d11	d12	d13	d14	d15	d16
MM411	✓	✓	✓														✓	✓	✓	✓												
CE421	✓		✓	✓	✓												✓	✓														
CE422	✓	✓	✓	✓	✓												✓	✓	✓	✓	✓	✓	✓									

TEACHING AND LEARNING METHODS

	Intended Learning Outcomes (ILO's) of the program	Teaching and Learning Methods						
		Lecture	Tutorials exercises	Practical exercises	Workshops	Projects	Case study	Data collection
Knowledge and Understanding	a.1) Recognize the essential mathematics relevant to computer science.	✓	✓					
	a.2) Explain code written in high-level programming languages	✓	✓	✓				
	a.3) Demonstrate basic knowledge and understanding of a core of mathematical analysis.	✓			✓			
	a.4) Demonstrate basic knowledge and understanding of a core of statistics.	✓	✓					
	a.5) Interpret and analyze data qualitatively and/or quantitatively.		✓				✓	
	a.6) Describe the principles and techniques of a number of application areas informed by the research directions of computer science.	✓					✓	✓
	a.7) Show a critical understanding of the principles of artificial intelligence, image, and pattern recognition.	✓	✓	✓		✓		✓
	a.8) Define the fundamental topics in computer systems, including hardware architectures and operating systems.	✓	✓	✓	✓		✓	
	a.9) Define the fundamental topics in computer science, including software architectures, software engineering principles and methodologies, and software tools.	✓	✓	✓	✓			✓
	a.10) Define advanced topics to provide a deeper understanding of some aspects of the hardware systems design, operating systems, computer security and compiler theory	✓	✓	✓	✓	✓	✓	✓
	a.11) Discuss advanced topics to provide a deeper understanding of some aspects of object-oriented analysis and design, and software engineering.	✓	✓			✓		✓
	a.12) Identify advanced topics to provide a deeper understanding of some aspects of the artificial intelligence, image processing, and computer graphics and animation.	✓	✓	✓		✓		✓
	a.13) Express strong knowledge of fundamentals of programming and the construction of computer-based systems	✓	✓	✓		✓		
	a.14) Describe strong knowledge of fundamentals of data structures and algorithms.	✓	✓	✓	✓		✓	
	a.15) Show a critical understanding of the broad context within computing including issues such as quality, reliability, enterprise, employment law and accounting	✓			✓		✓	
	a.16) Provide a deeper understanding of legal, professional and moral aspects of the exploitation of computing	✓			✓			

Intended Learning Outcomes (ILO's) of the program	Teaching and Learning Methods						
	Lecture	Tutorials exercises	Practical exercises	Workshops	Projects	Case study	Data collection
a.17) Recognize the knowledge of the tools, practices and methodologies used in the specification, design, implementation and critical evaluation of computer software systems	✓	✓	✓		✓	✓	
a.18) Define and assess criteria for measuring the extent to which a computer system is appropriate for its current deployment and future evolution.	✓			✓			✓
a.19) Define of the current and underlying technologies that support computer processing and inter-computer communication	✓	✓	✓				
a.20) Define the principals of generating tests which investigate the functionality of computer programs and computer systems and evaluating their results.	✓	✓	✓		✓		✓
Intellectual Skills b.1)Formulate traditional and nontraditional problems, set goals towards solving them, and observe results.		✓	✓			✓	
b.2) Compare between (algorithms, methods, techniques...etc).		✓			✓	✓	
b.3) Classify (data, results, methods, techniques, algorithms.. etc.).		✓			✓	✓	
b.4) Identify attributes, components, relationships, patterns, main ideas, and errors.		✓				✓	
b.5) Conclude the result of the proposed solutions.			✓		✓		
b.6) Restrict solution methodologies upon their results.			✓		✓		
b.7) Compose criteria, and verify solutions.			✓		✓	✓	
b.8) Identify a range of solutions and critically evaluate and justify proposed design solutions		✓	✓				
b.9) Solve computer science problems with pressing, commercial or industrial constraints.			✓		✓	✓	
b.10) Generate an innovative design to solve a problem containing a range of commercial and industrial constraints.			✓		✓		
b.11) Formulate and model computer systems at different and appropriate levels of abstraction.		✓	✓				
b.12) Create and/or justify designs to satisfy given requirements (synthesis, evaluation, application).			✓			✓	✓
b.13) Analyzes and evaluate a range of options in producing a solution to an identified problem.		✓	✓		✓		

Intended Learning Outcomes (ILO's) of the program		Teaching and Learning Methods						
		Lecture	Tutorials exercises	Practical exercises	Workshops	Projects	Case study	Data collection
	b.14) Analyze problem from written descriptions; derive requirements specifications from an understanding of problems (analysis, synthesis).		✓	✓		✓	✓	
	b.15) Outline the concepts, principles, theories and practices underpinning computing as an academic discipline.		✓	✓	✓		✓	
	b.16) Develop 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.17) Create ideas, proposals and designs effectively using rational and reasoned arguments for presentation to a range of audiences.		✓	✓		✓		
	b.18) Evaluate the results of tests to investigate the functionality of computer systems			✓	✓	✓	✓	
Professional Skills	c.1) Use appropriate programming languages and design methodologies.		✓	✓		✓		
	c.2) Use appropriate web-based systems, tools and design methodologies.		✓	✓		✓		
	c.3) Use appropriate database systems.		✓	✓		✓		
	c.4) Perform independent information acquisition and management, using the scientific literature and Web sources.	✓					✓	✓
	c.5) Specify, design, and implement computer-based systems.	✓	✓	✓		✓		
	c.6) Evaluate systems in terms of general quality attributes and possible tradeoffs	✓	✓		✓			✓
	c.7) Apply the principles of effective information management, information organization, and information-retrieval skills to information of various kinds, including text, images, sound, and video		✓	✓	✓			✓
	c.8) Apply the principles of human-computer interaction to the evaluation and construction of a wide range of materials including user interfaces, web pages, and multimedia systems		✓	✓	✓			✓
	c.9) Identify any risks or safety aspects that may be involved in the operation of computing equipment within a given context.	✓			✓			✓
	c.10) Deploy effectively the tools used for the construction and documentation of software, with particular emphasis on understanding the whole process involved in using computers to solve practical problems.		✓	✓		✓	✓	

		Teaching and Learning Methods						
Intended Learning Outcomes (ILO's) of the program		Lecture	Tutorials exercises	Practical exercises	Workshops	Projects	Case study	Data collection
	c.11) Make effective use of general computing facilities, plan and manage a project to complete within budget and schedule.		✓		✓			✓
	c.12) Appreciate and manage the need for continuing professional development in recognition of the need for lifelong learning.	✓			✓			✓
	c.13) Address and apply professional, moral and ethical issues within the discipline.	✓			✓			
	c.14) Operate computing equipment efficiently, taking into account its logical and physical properties.		✓	✓		✓		
	c.15) Use investigative skills to research new and novel aspects of their work	✓			✓			✓
	c.16) Apply tools and techniques for the design and development of applications		✓	✓		✓		✓
General Skills	d.1) Communicate effectively by oral, written and visual means.		✓	✓		✓		
	d.2) Work effectively as an individual and as a member of a team.		✓			✓		
	d.3) Collaborate effectively within multidisciplinary team.		✓			✓		
	d.4) Work in stressful environment and within constraints.			✓		✓		
	d.5) Prepare and present seminars to a professional standard.		✓	✓		✓		
	d.6) Prepare technical reports, and a dissertation, to a professional standard; use IT skills and display mature computer literacy.		✓	✓		✓		
	d.7) Demonstrate efficient IT capabilities.		✓	✓	✓	✓		
	d.8) Lead and motivate individuals.		✓			✓		
	d.9) Manage tasks and resources.		✓	✓		✓		
	d.10) Search for information and adopt life-long self-learning.		✓	✓		✓		✓
	d.11) Acquire entrepreneurial skills.			✓		✓		
	d.12) Manage one's own learning and development.		✓	✓		✓		
	d.13) Prepare their work in the form of reports.		✓	✓		✓		
	d.14) Communicate effectively with team members, managers and costumers.		✓	✓		✓		
	d.15) Exhibit appropriate numeracy skills in understanding and presenting cases involving a quantitative dimension.		✓	✓				
	d.16) Develop a range of fundamental research skills, through the use of online resources, technical repositories and library-based material.		✓	✓		✓		✓

1- ASSESMENT METHODS

	Intended Learning Outcomes (ILO's) of the program	Final Exam	Mid-Term Exam	Practical Exam	Class Work	Oral Exam
Knowledge and Understanding	a.1) Recognize the essential mathematics relevant to computer science.	✓	✓			
	a.2) Explain code written in high-level programming languages	✓	✓	✓	✓	
	a.3) Demonstrate basic knowledge and understanding of a core of mathematical analysis.	✓	✓		✓	
	a.4) Demonstrate basic knowledge and understanding of a core of statistics.	✓	✓		✓	
	a.5) Interpret and analyze data qualitatively and/or quantitatively.	✓	✓		✓	
	a.6) Describe the principles and techniques of a number of application areas informed by the research directions of computer science.	✓	✓			
	a.7) Show a critical understanding of the principles of artificial intelligence, image, and pattern recognition.	✓	✓	✓	✓	
	a.8) Define the fundamental topics in computer systems, including hardware architectures and operating systems.	✓	✓		✓	
	a.9) Define the fundamental topics in computer science, including software architectures, software engineering principles and methodologies, and software tools.	✓	✓	✓	✓	
	a.10) Define advanced topics to provide a deeper understanding of some aspects of the hardware systems design, operating systems, computer security and compiler theory	✓	✓	✓	✓	
	a.11) Discuss advanced topics to provide a deeper understanding of some aspects of object-oriented analysis and design, and software engineering.	✓	✓		✓	
	a.12) Identify advanced topics to provide a deeper understanding of some aspects of the artificial intelligence, image processing, and computer graphics and animation.	✓	✓	✓	✓	
	a.13) Express strong knowledge of fundamentals of programming and the construction of computer-based systems	✓	✓	✓	✓	
	a.14) Describe strong knowledge of fundamentals of data structures and algorithms.	✓	✓	✓	✓	
	a.15) Show a critical understanding of the broad context within computing including issues such as quality, reliability, enterprise, employment law and accounting	✓	✓		✓	
	a.16) Provide a deeper understanding of legal, professional and moral aspects of the exploitation of computing	✓	✓			
	a.17) Recognize the knowledge of the tools, practices and methodologies used in the specification, design, implementation and critical evaluation of computer software systems	✓	✓		✓	
	a.18) Define and assess criteria for measuring the extent to which a computer system is appropriate for its current deployment and future evolution.	✓	✓			
	a.19) Define of the current and underlying technologies that support computer processing and inter-computer communication	✓	✓		✓	

	Intended Learning Outcomes (ILO's) of the program	Assessment methods				
		Final Exam	Mid-Term Exam	Practical Exam	Class Work	Oral Exam
	a.20) Define the principals of generating tests which investigate the functionality of computer programs and computer systems and evaluating their results.	✓	✓		✓	
Intellectual Skills	b.1) Formulate traditional and nontraditional problems, set goals towards solving them, and observe results.	✓	✓		✓	
	b.2) Compare between (algorithms, methods, techniques...etc).	✓	✓		✓	
	b.3) Classify (data, results, methods, techniques, algorithms.. etc.).	✓	✓		✓	
	b.4) Identify attributes, components, relationships, patterns, main ideas, and errors.	✓	✓		✓	
	b.5) Conclude the result of the proposed solutions.	✓	✓		✓	
	b.6) Restrict solution methodologies upon their results.	✓	✓		✓	
	b.7) Compose criteria, and verify solutions.	✓	✓		✓	
	b.8) Identify a range of solutions and critically evaluate and justify proposed design solutions	✓	✓		✓	
	b.9) Solve computer science problems with pressing, commercial or industrial constraints.	✓	✓		✓	
	b.10) Generate an innovative design to solve a problem containing a range of commercial and industrial constraints.	✓	✓		✓	
	b.11) Formulate and model computer systems at different and appropriate levels of abstraction.	✓	✓	✓	✓	
	b.12) Create and/or justify designs to satisfy given requirements (synthesis, evaluation, application).	✓	✓	✓	✓	
	b.13) Analyzes and evaluate a range of options in producing a solution to an identified problem.	✓	✓		✓	
	b.14) Analyze problem from written descriptions; derive requirements specifications from an understanding of problems (analysis, synthesis).	✓	✓		✓	
	b.15) Outline the concepts, principles, theories and practices underpinning computing as an academic discipline.	✓	✓	✓	✓	
	b.16) Develop 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.17) Create ideas, proposals and designs effectively using rational and reasoned arguments for presentation to a range of audiences.				✓	
	b.18) Evaluate the results of tests to investigate the functionality of computer systems			✓	✓	
Professional Skills	c.1) Use appropriate programming languages and design methodologies.	✓	✓	✓	✓	
	c.2) Use appropriate web-based systems, tools and design methodologies.	✓	✓	✓	✓	
	c.3) Use appropriate database systems.	✓	✓	✓	✓	
	c.4) Perform independent information acquisition and management, using the scientific literature and Web sources.			✓	✓	
	c.5) Specify, design, and implement computer-based systems.	✓	✓	✓	✓	
	c.6) Evaluate systems in terms of general quality attributes and possible tradeoffs	✓	✓		✓	

Intended Learning Outcomes (ILO's) of the program		Assessment methods				
		Final Exam	Mid-Term Exam	Practical Exam	Class Work	Oral Exam
	c.7) Apply the principles of effective information management, information organization, and information-retrieval skills to information of various kinds, including text, images, sound, and video	✓	✓	✓	✓	
	c.8) Apply the principles of human-computer interaction to the evaluation and construction of a wide range of materials including user interfaces, web pages, and multimedia systems	✓	✓	✓	✓	
	c.9) Identify any risks or safety aspects that may be involved in the operation of computing equipment within a given context.	✓	✓		✓	
	c.10) Deploy effectively the tools used for the construction and documentation of software, with particular emphasis on understanding the whole process involved in using computers to solve practical problems.	✓	✓	✓	✓	
	c.11) Make effective use of general computing facilities, plan and manage a project to complete within budget and schedule.	✓	✓		✓	
	c.12) Appreciate and manage the need for continuing professional development in recognition of the need for lifelong learning.	✓	✓			
	c.13) Address and apply professional, moral and ethical issues within the discipline.	✓	✓			
	c.14) Operate computing equipment efficiently, taking into account its logical and physical properties.	✓	✓	✓	✓	
	c.15) Use investigative skills to research new and novel aspects of their work	✓	✓		✓	
	c.16) Apply tools and techniques for the design and development of applications	✓	✓	✓	✓	
General Skills	d.1) Communicate effectively by oral, written and visual means.	✓	✓	✓	✓	✓
	d.2) Work effectively as an individual and as a member of a team.			✓	✓	
	d.3) Collaborate effectively within multidisciplinary team.			✓	✓	
	d.4) Work in stressful environment and within constraints.			✓	✓	
	d.5) Prepare and present seminars to a professional standard.			✓	✓	
	d.6) Prepare technical reports, and a dissertation, to a professional standard; use IT skills and display mature computer literacy.		✓		✓	
	d.7) Demonstrate efficient IT capabilities.			✓	✓	✓
	d.8) Lead and motivate individuals.			✓	✓	
	d.9) Manage tasks and resources.	✓	✓	✓	✓	
	d.10) Search for information and adopt life-long self-learning.	✓	✓	✓	✓	✓
	d.11) Acquire entrepreneurial skills.			✓	✓	
	d.12) Manage one's own learning and development.			✓	✓	
	d.13) Prepare their work in the form of reports.			✓	✓	
	d.14) Communicate effectively with team members, managers and costumers.			✓	✓	
	d.15) Exhibit appropriate numeracy skills in understanding and presenting cases involving a quantitative dimension.	✓	✓	✓	✓	
	d.16) Develop a range of fundamental research skills, through the use of online resources, technical repositories and library-based material.			✓	✓	

Program Coordinator: Prof. Khaled Fathy Hussain

Signature:

Approved by the Dean: Prof. Taysir Hassan Soliman

Signature: