

ASSIUT UNIVERSITY



**Bioinformatics**  
**Undergraduate Program**  
**2017-2018**



**Faculty of**  
**Computers and Information**  
**Dept. of Information System**





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Assiut University

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Faculty of Computers &  
Information

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# Bioinformatics Undergraduate Program

(Credit Hours System)

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*Program  
Specifications*



*Assiut University  
Faculty of Computers & Information  
Department of Information Systems  
Quality Assurance Unit*



# Bioinformatics Undergraduate Program

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# Bioinformatics Program Specifications

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## A. Basic Information

1. **Program Title:** Bioinformatics
2. **Program Type:** Single
3. **Faculty (Faculties):** Faculty of Computers and Information
4. **Department:** Information Systems
5. **Assistant Coordinator:** Dr. Mohamed Fawzy
6. **Coordinator:** Prof. Taysir Hassan Abdel Hamid
7. **Last date of program specifications approval:**

## B. Professional Information

### 1. Program Aims and Objectives

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 IS2010 and IS2002) and international universities the Bioinformatics program aims to provide the students with:

- I. Improving Organizational Processes
- II. Exploiting Opportunities Created by Technology Innovations
- III. Understanding and Addressing Information Requirements
- IV. Designing and Managing Enterprise Architecture
- V. Identifying and Evaluating Solution and Sourcing Alternatives
- VI. Securing Data and Infrastructure
- VII. Understanding, Managing and Controlling IT Risks
- VIII. Managing and analyzing Biological data

### 2. Graduate attributes

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

- I. Recognizing problems that are amenable to computer information systems, and knowledge of the tools necessary for solving such problems.
- II. Understanding fundamentals of bioinformatics.
- III. Managing bioinformatics databases.
- IV. Developing solutions for bioinformatics applications.
- V. Understanding the fundamentals of System Development Life Cycle (SDLC).
- VI. Managing and exploiting organizational data and information; designing data and information models, managing information systems development resources and projects.

- VII. Implementing solutions, including use of appropriate programming languages, web-based systems and tools, design methodologies, and database systems.
- VIII. Applying the principles of effective information management, information organizations, information mining, and information-retrieval skills to information of various kinds, including text, images, sound, and video.
- IX. Know the fundamentals of intelligent information systems technologies.
- X. Specify, design, and implement computer-based information systems, and evaluate them in terms of general quality attributes and possible tradeoffs presented within the given problem.
- XI. Applying Information Systems solutions to functional, inter-organizational, operational, managerial, and executive problems and opportunities.
- XII. Describing characteristics of various components of information systems, use the appropriate tools and techniques to analyze, design, and construct information systems.
- XIII. Communicating effectively by oral, written and visual means.
- XIV. Working effectively as an individual and as a member of a team.
- XV. Perform independent and efficient time management.
- XVI. Identify key ethical issues affecting information systems and their responsibilities as information science professionals.

### 3. Intended Learning Outcomes (ILOs)

#### a. Knowledge and Understanding

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

- a1. Demonstrate basic knowledge and understanding of a core of analysis, algebra, applied mathematics and statistics.
- a2. Demonstrate strong knowledge of bioinformatics.
- a3. Demonstrate strong skills of biological database management systems.
- a4. Describe the principles and techniques of a number of application areas informed by the research directions of bioinformatics.
- a5. Explain the broad context within which bioinformatics including issues such as quality and reliability.
- a6. Identify bioinformatics applications, such as forensics, personalized medicine, agriculture, drug discovery, nano-informatics, and biodiversity informatics, etc.
- a7. Identify selected specialist fields at the forefront of information systems.
- a8. Discuss the principles of Information communication.
- a9. Describe the challenges inherent in the maintenance and evolution of software systems, and the techniques and best practices currently available for dealing with them.
- a10. Discuss some aspects of object-oriented analysis and design.
- a11. Explain decision support tools and systems.
- a12. Identify various approaches to Management Sciences (MS), such as Project Management.
- a13. Interpret and analyze data qualitatively and/or quantitatively.
- a14. Demonstrate strong knowledge of fundamentals of programming and the construction of computer-based systems, data structures, bioinformatics algorithms, software engineering techniques and information retrieval.
- a15. Demonstrate a deep knowledge of structural bioinformatics.
- a16. Define the tools, practices and methodologies used in the specification, design, implementation and critical evaluation of computer and information systems.
- a17. Define the methods used in defining and assessing criteria for measuring the extent to which an information system is appropriate for its current deployment and future evolution.
- a18. Describe the current and underlying technologies that support computer processing and inter-computer communication.
- a19. Discuss developments in research fields across a range of knowledge areas.

#### **b. Intellectual Skills**

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

- b1. Define traditional and nontraditional information systems problems, set goals towards solving them, and observe results.
- b2. Perform comparisons between (methods, techniques...etc).
- b3. Identify attributes, components, relationships, patterns, main ideas, and errors.
- b4. Summarize the proposed solutions and their results.
- b5. Restrict solution methodologies upon their results.
- b6. Establish criteria, and verify solutions.
- b7. Identify a range of solutions and critically evaluate and justify proposed design solutions.
- b8. Solve information systems problems with pressing commercial or industrial constraints.
- b9. Generate an innovative design to solve a problem containing a range of commercial and industrial constraints.
- b10. Perform problem analysis from written descriptions;
- b11. Derive requirements specifications from an understanding of problems (analysis, synthesis).
- b12. Create and/or justify designs to satisfy given requirements (synthesis, evaluation, application).
- b13. Solve a decision model with appropriate techniques.
- b14. Solve complex problems within and between enterprises.
- b15. Perform improvement of a system that benefits stakeholders.
- b16. Recognize the professional, moral and ethical issues involved in the exploitation of Information Technology and be guided by their adoption, reflect on issues of professional practice within the discipline.
- b17. Apply the concepts, principles, theories and practices underpinning computing as an academic discipline.
- b18. Synthesize ideas, proposals and designs effectively using rational and reasoned arguments for presentation to a range of audiences.
- b19. Generate and evaluate the results of tests to investigate the functionality of information systems.

#### **c. Professional and Practical Skills**

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

- c1. Use appropriate programming languages.
- c2. Use appropriate web-based systems and tools, and design methodologies.
- c3. Use appropriate database management systems.
- c4. Apply the principles of effective information management, information organization, and information-retrieval skills to information of various kinds, including text, images, sound, and video.
- c5. 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.
- c6. Identify any risks or safety aspects that may be involved within a given context.
- c7. 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.
- c8. Implement data and model centered systems.
- c9. Operate computing equipment effectively, recognizing its logical and physical properties, capabilities and limitations.
- c10. Commercialize knowledge and skills to computing community and industry.

#### **d. General and Transferable Skills**

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

- d1. Collaborate effectively within multidisciplinary team.
- d2. Work in stressful environment and within constraints.

- d3. Communicate effectively using a variety of communication methods.
- d4. Communicate effectively with team members, managers and customers.
- d5. Demonstrate efficient IT capabilities.
- d6. Lead and motivate individuals.
- d7. Manage tasks and resources.
- d8. Search for information and adopt life-long self-learning.
- d9. Acquire entrepreneurial skills.
- d10. Acquire analytical thinking and problem solving skills
- d11. Effectively employ information-retrieval skills, (including the use of browsers, search engines, and on-line library catalogues).
- d12. Ability to work independently and as part of a team with minimum guidance.
- d13. Manage one's own learning and development, including time management and organizational skills.
- d14. Prepare their work in the form of reports, oral presentations or an internet web site.
- 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.

The

##### 4b. Comparison of provision to external references

The bioinformatics program 100% matches NARS reference

See the attached document “Program Matrices”.

#### 5. Curriculum Structure and Contents

5a. Program duration: 4 academic years (B. IS) Full Time attendance.

5b. Program structure

- No. of hours per week: Lectures (17), Lab./Tut. (13), Total (30)
- No. of hours: Compulsory (172), Elective (10)
- No. of hours of basic sciences courses: 28, 19.44%
- No. of hours of courses of social sciences and Humanities: 18, 12.5%
- No. of hours of basic computer courses: 88, 48.8%
- No. of hours of specialized computer courses: 42, 29.17%
- Field Training: 14, 9.7%
- No. of hours of basic computing courses: 42, 29.17%
- Program Levels (in credit-hours system): applicable.

The following table summarizes these figures and show how they can be compared with the national academic standard levels.

Subject Area	IS Program %	Tolerance
Humanities, ethical and Social Sciences (Univ. Req.)	8 %	8-10 %
Mathematics and Basic Sciences	15 %	16-18 %
Basic Computing Sciences (institution req.)	24 %	26-28 %
Applied Computing Sciences (specialization)	33 %	28-30 %





### Institution requirements

Code/ course No.	Course Title	Credits	Prerequisites	No. of hours /week			Semester	Achieved ILOs			
				Lec.	Practical.	tutorial		a's	b's	c's	d's
				MATH101	Mathematics I	3		-	3		1
MATH102	Mathematics II	3	MATH101	3		2		a1- a5	b1- b6	c1- c4	d1- d3
MATH202	Probability and Statistics	2	MATH102	2	<b>2 H<sup>T</sup></b>			a1- a5	b1- b6	c1- c4	d1- d3
MATH201	Mathematics III	3	MATH102	3		2	1 <sup>st</sup>	a1- a5	b1- b6	c1- c4	d1- d3
PHYS101	Physics I	3	-	2	<b>2 H<sup>S</sup></b>		1 <sup>st</sup>	a1- a6	b1- b5	c1- c6	d1- d6
PHYS102	Introduction to Biophysics	3	PHYS101	2	<b>2 H<sup>S</sup></b>		2 <sup>nd</sup>	a1, a13	b3, b7, b10	c4, c6, c9	d4, d6, d7, d12, d13
BIO101	Introduction to Biology	2		2		1	1 <sup>st</sup>	a1- a6	b1- b5	c1- c6	d1- d6
BOT301	Introduction to Molecular Cell Biology	2	BIO101	2		1		a1- a6	b1- b5	c1- c6	d1- d6
CHEM201	Introduction to BioChemistry	2		2		1		a1	b2- b4, b6, b7	c6, c9	d2, d4, d6, d7, d12, d13
EE101	Electronics	3	-	2	<b>2 H<sup>S</sup></b>			a1	b2- b4, b6, b7	c6, c9	d2, d4, d6, d7, d12, d13
EE102	Digital Circuits	3	EE101	2	<b>2 H<sup>S</sup></b>			a1	b2- b4, b6, b7,	c6, c9	d2, d4, d6, d7, d12, d13

### Basic Computing Science requirements

Code/ course No.	Course Title	Credits	Prerequisites	No. of hours /week			Semester	Achieved ILOs			
				Lec.	Practical.	tutorial		a's	b's	c's	d's
CS141	Programming Fundamentals	3	IT101	3	3 H <sup>T</sup>			a1-a2, a4-a7	b1-b5	c1-c3	d1-d5
CS211	Data Structures and Algorithms	3	CS241	3	2 H <sup>T</sup>			a1-a5	b1-b11	c1-c7	d1-d5
CS241	Object-Oriented Programming	3	CS141	3	2 H <sup>T</sup>			a1-a5	b1-b5	c1-c7	d1-d5
CE211	Computer Architecture	3	IT101, CS201	3	2 H <sup>T</sup>		1 <sup>st</sup>	a14, a19	b2,b17, b18,	c1, c7,	d2, d8, d13, d14, d16
CS321	Operating Systems	3		3	2 H <sup>T</sup>			a1-a5	b1-b11	c1-c7	d1-d5
IS211	File Organization	2	CS141	2	2 H <sup>T</sup>			a1-a5	b1-b5	c1-c7	d1-d5
CS391	Software Engineering	3	CS211	3		2		a2-a9	b1-b15	c1-c6	d1-d6
CS361	Artificial Intelligence	3	CS201		2 H <sup>T</sup>						
IS201	Foundations of Information Systems	2	IT101	3	2 H <sup>T</sup>			a1-a7	b1-b10	c1-c8	d1-d7
IS212	Databases	3	IS201	3	2 H <sup>T</sup>			a1-a8	b1-b4	c1-c6	d1-d7
IS221	Project Management	2	IT101	2	2 H <sup>T</sup>			a1-a7	b1-b10	c1-c8	d1-d7
IS231	Systems Analysis and Design	3	IT101	3		2		a1-a5	b1-b15	c1-c5	d1-d8
CS381	Software Development and Professional Practice	3	CS211, CS391	3				a1-a5	b1-b15	c1-c5	d1-d8
IT101	IT Fundamentals	3	-	3	3 H <sup>T</sup>		1 <sup>st</sup>	a1-a9	b1-b4	c1-c4	d1-d4
IT251	Data Communications	3	IT101					a1-a7	b1-b4	c1-c5	d1-d6
IT351	Computer Networks	3	IT251, CE221					a1-a7	b1-b5	c1-c7	d1-d9
IT371	Web Programming	3	CS141, IT251					a1-a8	b1-b3	c1-c6	d1-d7
IS2212	Advanced Project Management	3	IS321	3	H <sup>O</sup>	3		a1-a7	b1-b10	c1-c8	d1-d7

### Specialization requirements

Code/ course No.	Course Title	Credits	Prerequisites	No. of hours /week			Semester	Achieved ILOs			
				Lec.	Practical.	tutorial		a's	b's	c's	d's
BNF301	Introduction to Bioinformatics	3	BIO111,CHE M211, IS201, IS212	3	2 H <sup>T</sup>			a1-a5	b1-b5	c1-c5	d1-d6
BNF302	Algorithms in Bioinformatics	3	BNF301	3	2 H <sup>T</sup>			a1-a8	b1-b8	c1-c7	d1-d6
BNF303	Scripting Languages in Bioinformatics	3	BNF311, CS141	3	2 H <sup>T</sup>			a1-a8	b1-b8	c1-c7	d1-d6
IS412	Distributed and Object Databases	3	IS212	3	2 H <sup>T</sup>			a 1 - a4	b 1- b6	c 1- c2	d1- d6
BNF431	Semantic Data Integration in Life Sciences	3	IS201	3	2 H <sup>T</sup>			a 1- a8	b 1- b6	c 1- c4	d 1- d 5
BNF402	Genomic Bioinformatics	3	BNF301	3	2 H <sup>T</sup>			a 1- a6	b1- b5	c1-c6	d1- d5
GEN414	Genetic Engineering	2	GEN201	2				a 1- a8	b 1- b6	c 1- c4	d 1- d 5
BNF422	Computational Biology Techniques I	3	BNF301, BNF302	3	2 H <sup>T</sup>			a 1- a8	b 1- b6	c 1- c4	d 1- d 5
BNF424	Computational Biology Techniques II	3	BNF414, BNF422	3	2 H <sup>T</sup>			a 1- a8	b 1- b6	c 1- c4	d 1- d 5
BNF412	Seminars in Bioinformatics	3	BNF311	3	2 H <sup>T</sup>			a 1- a8	b 1- b6	c 1- c4	d 1- d 5
BNF411	Scientific Data Management	3	BNF431	3	2 H <sup>T</sup>			a 1- a8	b 1- b6	c 1- c4	d 1- d 5
BNF415	Bioinformatics Capstone Project I	3	CS381, IS221	3				a 1- a8	b 1- b6	c 1- c4	d 1- d 5
BNF416	Bioinformatics Capstone Project II	3	BNF416	3				a 1- a8	b 1- b6	c 1- c4	d 1- d 5
IS441	Quality Assurance of Information Systems	3	IS201	3	2 H <sup>T</sup>			a 1- a8	b 1- b6	c 1- c4	d 1- d 5
IS442	IS Application Development	3	IS212	3	2 H <sup>T</sup>			a 1- a8	b 1- b6	c 1- c4	d 1- d 5
BNF414	Biological Databases	3	IS212	3	2 H <sup>T</sup>			a 1- a8	b 1- b6	c 1- c4	d 1- d 12

## a. Compulsory Courses (by levels)

<b>Specialization requirements</b>											
Code/ course No.	Course Title	Credits	Prerequisites	No. of hours /week			Semester	Achieved ILOs			
				Lec.	Practical.	tutorial		a's	b's	c's	d's
<b>Level 1</b>											
CS141	Programming Fundamentals	3	IT101	3	3 H <sup>T</sup>		2nd	a1-a9	b1-b4	c1-c3	d1-d5
IT101	IT Fundamentals	3	-	3	3 H <sup>T</sup>		1 <sup>st</sup>	a18	b3	c10	d5, d7, d13
MATH102	Mathematics II	3	MATH101	3		2		a1-a5	b1-b6	c1-c4	d1-d3
MATH202	Probability and Statistics	2	MATH102	2	2 H <sup>T</sup>			a1-a5	b1-b6	c1-c4	d1-d3
PHYS101	Physics I	3	-	2	2 H <sup>S</sup>		1 <sup>st</sup>	a1-a5	b1-b5	c1-c5	d1-d5
PHYS102	Introduction to Biophysics	3	-	2	2 H <sup>S</sup>	1	2 <sup>nd</sup>	a1, a13	b3, b7, b10	c4, c6, c9	d4, d6, d7, d12, d13
BIO111	Introduction to Biology	2		2		1	1 <sup>st</sup>	a1-a6	b1-b5	c1-c6	d1-d6
BOT321	Introduction to Molecular Cell Biology	2	BIO111	2		1		a1-a6	b1-b5	c1-c6	d1-d6
EE101	Electronics	3	-	2	2 H <sup>S</sup>			a1	b2-b4, b6, b7	c6, c9	d2, d4, d6, d7, d12, d13
EE102	Digital Circuits	3	EE101	2	2 H <sup>S</sup>			a1	b2-b4, b6, b7,	c6, c9	d2, d4, d6, d7, d12, d13
HUM111	English Language I	2		2			1 <sup>st</sup>	a1	b 1, b 2	c 1, c 2, c 3	d1, d 2, d 3, d4, d5, d6, d7
HUM121	Social Context of Computing	1	-	1				a 1, a 2, a 3	b 1, b 2, b 3	c 1, c 2, c 3	d1, d 2, d 3, d4, d5, d6, d7, d8, d9
HUM132	Interpersonal Communication	2	-	2				a 1, a 2, a 3	b 1, b 2, b 3	c 1, c 2, c 3	d1, d 2, d 3, d4, d5, d6, d7, d8, d9

Specialization requirements											
Code/ course No.	Course Title	Credits	Prerequisites	No. of hours /week			Semester	Achieved ILOs			
				Lec.	Practical.	tutorial		a's	b's	c's	d's
Subtotal		36									

Specialization requirements											
Code/ course No.	Course Title	Credits	Prerequisites	No. of hours /week			Semester	Achieved ILOs			
				Lec.	Practical.	tutorial		a's	b's	c's	d's
<b>Level 2</b>											
CS211	Data Structures and Algorithms	3	CS241	3	2 H <sup>T</sup>			a1-a5	b1-b11	c1-c7	d1-d5
CS241	Object-Oriented Programming	3	CS141	3	2 H <sup>T</sup>			a1-a5	b1-b5	c1-c7	d1-d5
IS201	Foundations of Information Systems	2	IT101	2	2 H <sup>T</sup>			a1-a7	b1-b10	c1-c8	d1-d7
IS212	Databases	3	IS201	3	2 H <sup>T</sup>			a1-a8	b1-b4	c1-c6	d1-d7
IS221	Project Management	2	IT101	2	2 H <sup>O</sup>			a1-a2	b1-b2	c1	d1-d6
IS211	File Organization	2	CS241	2	2 H <sup>T</sup>			a1-a9	b1-b4	c1-c6	d1-d6
IS231	Systems Analysis and Design	3	IT101	3		2		a1-a5	b1-b15	c1-c5	d1-d8
HUM231	Business Administration	2	-	2				a1-a2	b1-b3	c1-c3	d1-d7
HUM232	Technical Writing	2	HUM111	2				a 1, a 2, a 3	b 1, b 2, b 3	c 1, c 2, c 3	d1-d9
HUM241	Computers and Ethics	1	-	1				a1-a2	b1-b3	c1-c3	d1-d7
Subtotal											

Specialization requirements											
Code/ course No.	Course Title	Credits	Prerequisites	No. of hours /week			Semester	Achieved ILOs			
				Lec.	Practical.	tutorial		a's	b's	c's	d's
<b>Level3</b>											
CE221	Computer Architecture	3	IT101, CS201	3	2 H <sup>T</sup>			a14, a19	b2, b17, b18	c1,c7	d2, d8, d13, d14, d16
CS381	Software Development and Professional Practice	3	CS211, CS391	3	3 H <sup>O</sup>			a1-a10	b1-b15	c1-c6	d1-d6
CS361	Artificial Intelligence	3	IT101, CS201	3	2 H <sup>T</sup>			a1-a7	b1-b8	c1-c6	d1-d8

Specialization requirements											
Code/ course No.	Course Title	Credits	Prerequisites	No. of hours /week			Semester	Achieved ILOs			
				Lec.	Practical.	tutorial		a's	b's	c's	d's
BNF325	Field Training	3	IS221	3				a1- a8	b1- b10	c1- c8	d1- d12
CS391	Software Engineering	3	CS211	3		2		a2- a9	b1- b15	c1- c6	d1- d6
BNF301	Introduction to Bioinformatics	3	BIO111,CHE M211, IS201, IS212	3	2 H <sup>T</sup>			a1-a5	b1- b5	c1- c5	d1- d6
BNF302	Algorithms in Bioinformatics	3	BNF301	3	2 H <sup>T</sup>			a1-a8	b1- b8	c1-c7	d1- d6
BNF303	Scripting Languages in Bioinformatics	3	BNF301, CS141	3	2 H <sup>T</sup>			a1-a8	b1- b8	c1- c7	d1- d6
IT351	Computer Networks	3	IT251, CE221					a1- a7	b1- b5	c1- c7	d1- d9
IT371	Web Programming	3	CS141, IT251					a1- a8	b1- b3	c1- c6	d1- d7
Subtotal		27									

Specialization requirements											
Code/ course No.	Course Title	Credits	Prerequisites	No. of hours /week			Semester	Achieved ILOs			
				Lec.	Practical.	tutorial		a's	b's	c's	d's
<b>Level4</b>											
IS412	Distributed and Object Databases	3	IS212	3			2nd	a 1 - a4	b 1- b6	c 1-c2	d1- d6
GEN101	Fundamentals of Genetics	3		2	2		1st	a 1 - a4	b 1- b6	c 1-c2	d1- d6
GEN102	Introduction to Molecular Genetics	3	GEN102	2	2		2nd	a 1 - a4	b 1- b6	c 1-c2	d1- d6
BNF415	Bioinformatics Capstone Project I	3	CS381, IS221	3	4 H <sup>S</sup>		1st	a 1 - a11	b 1- b11	c 1-c6	d1- d9
BNF416	Bioinformatics Capstone Project II	3	BNF415	3	4 H <sup>S</sup>		2nd	a 1 - a11	b 1- b11	c 1-c6	d1- d9
BNF421	Structural Bioinformatics	3	BNF301, BNF302	3			1st	a 1-a8	b 1- b6	c 1-c4	d 1- d 5,d1 2- d16
BNF411	Scientific Data Management	3	BNF412	3			2nd	a 1-a6	b1- b5	c1- c6	d1- d12
Subtotal		21									

## 6a. Elective Courses

General requirements											
Code/ course No.	Course Title	Credits	Prerequisites	No. of hours /week			Semester	Achieved ILOs			
				Lect.	Lab	Exe.		a's	b's	c's	d's
HUM112	English Language II	2	HUM111	2	-	-	-	a 1	b 1- b2	c 1-c3	d 1- d7
HUM122	Intellectual Property	1	-	1	-			a 1-a2	b 1- b3	c 1-c4	d 1- d7
HUM131	Organizational Behavior	2	-	2	-			a 1-a2	b 1- b3	c 1-c3	d 1- d7
HUM133	Computing Economics	2	-	2	-			a 1-a6	b 1- b2	c 1-c4	d 1- d7
HUM141	Computer Law	2	-	2	-			a 1-a5	b 1- b5	c 1-c3	d 1- d7
HUM142	Privacy and Civil Liberties	1	-	1	-			a 1-a5	b 1- b5	c 1-c3	d 1- d3
HUM151	Hand Drawing	2	-	1	3 H <sup>s</sup>			a 1-a4	b 1- b4	c 1-c3	d 1- d3
HUM152	History of Computing	2	-	2	-			a 1-a9	b 1- b3	c 1-c4	d 1- d3
HUM153	Islamic Culture	1	-	1	-			a 1-a2	b 1- b3	c 1-c3	d 1- d3
HUM154	Scientific Thinking	1	-	1	-			a 1-a2	b 1- b2	c 1	d 1- d3
Total		8									

Institution requirements											
Code/ course No.	Course Title	Credits	Prerequisites	No. of hours /week			Semester	Achieved ILOs			
				Lec.	Practica.	tutorial		a's	b's	c's	d's
CS201	Discrete Structures	3	MATH102	3	2 H <sup>T</sup>	2		a1-a3	b1- b5	c 1-c4	d 1- d4
MATH301	Numerical Analysis	3	MATH102	3		2		a1-a3	b1- b6	c 1-c7	d 1- d7
CS301	Operation Research	3	CS201	3	2 H <sup>T</sup>			a1-a3	b1- b2	c 1-c3	
CS302	Simulation and Modeling	3	MATH202	3	2 H <sup>T</sup>			a1-a4	b1- b2	c1-c2	d1- d3
EE201	Digital Signal Processing	3	MATH201	3	2 H <sup>T</sup>			a1-a3	b1- b5	c1-c4	d1- d4
Total		6									

Basic Computing Science requirements											
Code/ course No.	Course Title	Credits	Prerequisites	No. of hours /week			Semester	Achieved ILOs			
				Lec.	Practical.	tutorial		a's	b's	c's	d's
CS341	Visual Programming	3	CS211	3	2 H <sup>T</sup>			a1- a6	b1-b5	c1- c5	d1- d6



### Basic Computing Science requirements

Code/ course No.	Course Title	Credits	Prerequisites	No. of hours /week			Semester	Achieved ILOs			
				Lec.	Practical.	tutorial		a's	b's	c's	d's
CS351	Computer Graphics	3	IT101, CS201	3	2 H <sup>T</sup>		a1-a7	b1-b6	c1-c4	d1-d8	
CS321	Operating Systems	3		3	2 H <sup>T</sup>		a1-a7	b1-b6	c1-c4	d1-d8	
MM301	Introduction to Multimedia Technology	3	CS241	3	2 HT		a1-a3	b1-b6	c1-c7	d1-d7	
Total		6									

### Specialization requirements

Code/ course No.	Course Title	Credits	Prerequisites	No. of hours /week			Semester	Achieved ILOs			
				Lec.	Practical.	tutorial		a's	b's	c's	d's
IS321	Advanced Project Management	3	IS221	3			a1- a2	b1	c1	d1	
IS414	Data Mining and Business Intelligence	3	IS201	3	2 H <sup>T</sup>		a1- a4	b1- b5	c1- c2	d1- d8	
IS441	Quality Assurance of Information Systems	3	IS201	3	2 H <sup>O</sup>		a1- a9	b1- b13	c1- c6	d1- d12	
IS442	IS Application Development	3	IS212	3	2 H <sup>O</sup>		a1- a9	b1- b10	c1- c6	d1- d12	
BNF431	Semantic Data Integration in Life Sciences	3	IS201	3	2 H <sup>O</sup>		a1- a9	b1- b10	c1- c6	d1- d12	
BNF402	Genomic Bioinformatics	3	BNF301	3	2 H <sup>O</sup>		a1- a9	b1- b10	c1- c6	d1- d12	
GEN414	Genetic Engineering	2	GEN201	2	2 H <sup>O</sup>		a1- a9	b1- b10	c1- c6	d1- d12	
BNF422	Computational Biology Techniques I	3	BNF301, BNF302	3	2 H <sup>O</sup>		a1- a9	b1- b10	c1- c6	d1- d12	
BNF423	Computational Biology Techniques II	3	BNF422	3	2 H <sup>O</sup>		a1- a9	b1- b10	c1- c6	d1- d12	

### Specialization requirements

Code/ course No.	Course Title	Credits	Prerequisites	No. of hours /week			Semester	Achieved ILOs			
				Lec.	Practical.	tutorial		a's	b's	c's	d's
				BNF412	Seminars in Bioinformatics	3		BNF311	3	2 H <sup>o</sup>	
BNF424	Biological Databases	3	IS212, BNF301	3	2 H <sup>o</sup>		a1- a9	b1- b10	c1- c6	d1- d12	

*BIO Program  
Matrices*

*Assiut University*

*Faculty of Computers & Information*

*Department of Computer Science*

*Quality Assurance Unit*



## BIO Undergraduate Program Matrices

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

- 1. Program Matrix III (Courses – Knowledge and Understanding Skills)**  
This matrix shows how BIO Program Courses can cover Knowledge and Understanding Skills invoked in BIO Program Specifications.
- 2. Program Matrix IV (Courses – Intellectual Skills)**  
This matrix shows how BIO Program Courses can cover Intellectual Skills invoked in BIO Program Specifications.
- 3. Program Matrix V (Courses – Professional and Practical Skills)**  
This matrix shows how BIO Program Courses can cover Professional and Practical Skills invoked in BIO Program Specifications.
- 4. Program Matrix VI (Courses – Transferable Skills)**  
This matrix shows how BIO Program Courses can cover Transferable Skills invoked in BIO Program Specifications.

## 5. Academic Standards Matrix

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

**Academic Standards (Knowledge and Understanding Skills)(October2010) Bioinformatics**

<b>Bioinformatics Program ILOs</b>	<b>Corresponding in NARS</b>		<b>NARS ILOs - General</b>	<b>NARS ILOs - Special</b>
a1. Demonstrate basic knowledge and understanding of a core of analysis, algebra, applied mathematics and statistics.	K1	A1	K1.Essential facts, concepts, principles and theories relating to computing and information and computer applications as appropriate to the program of study.	A1. A core of analysis, algebra, applied mathematics and statistics.
a2. Demonstrate strong knowledge of bioinformatics.	K1	A2		A2. Information systems, data and
a3. Demonstrate strong skills of biological database management systems.	K2	A3	K2. Modeling and design of computer-based systems bearing in mind the trade-offs.	Information Management, enterprise architecture, IS project management, IT infrastructure, systems analysis and design, and IS strategies.
a4. Describe the principles and techniques of a number of application areas informed by the research directions of bioinformatics.	K2	A3		A3. Principles and techniques of database management systems,
a5. Describe the principles and techniques of a number of application areas informed by the research directions of bioinformatics.	K5	A4	K3.Tools, practices and methodologies used in the specification, design,	management, data mining, geographical information systems, multimedia, application development, business process management, enterprise systems, human- computer interaction, object-oriented analysis and design, e-technologies,
a6. Identify bioinformatics applications, such as forensics, personalized medicine, agriculture, drug discovery, nano informatics, and biodiversity informatics, etc.	K3	A3		design, e-technologies,
a7. Identify selected specialist fields at the forefront of information systems.	K8	A3		

Bioinformatics Program ILOs	Corresponding in NARS		NARS ILOs - General	NARS ILOs - Special				
a8. Discuss the principles of Information communication.	K4	A6	K4.Implementation and evaluation of computer software systems.	multimedia, image processing, information and infrastructures security and computer graphics techniques.				
a9. Describe the challenges inherent in the maintenance and evolution of software systems, and the techniques and best practices currently available for dealing with them.	K7	A3			K5.Criteria and specifications appropriate to specific problems, and plan strategies for their solution.	A4. Issues such as quality, reliability, enterprise, employment law, accounting and health.		
	K9	A3						
a10.Discuss some aspects of object-oriented analysis and design.	K5	A9						
a11.Explain decision support tools and systems.	K6	A2, A5						
a12.Identify various approaches to Management Sciences (MS), such as Project Management.	K11	A8	K6. Criteria and specifications appropriate to specific problems, and plan strategies for their solution.	A5. Awareness of organizational, human and economic sides of modern organizations.				
a13.Interpret and analyze data qualitatively and/or quantitatively.	K5	A3						
a14.Demonstrate strong knowledge of fundamentals of programming and the construction of computer-based systems, data structures, bioinformatics algorithms, software engineering techniques and information retrieval.	K10	A8	K7. Principals of generating tests which investigate the functionality of computer programs and computer systems and evaluating their results.	A6. Principles of Information communication and information security.				
a15.Demonstrate a deep knowledge of structural bioinformatics.	K2	A7				A7. Specification, analysis, design, implementation and operation and maintenance of IS solutions.		

Bioinformatics Program ILOs	Corresponding in NARS		NARS ILOs - General	NARS ILOs - Special
a16. Define the tools, practices and methodologies used in the specification, design, implementation and critical evaluation of computer and information systems.	K3	A8	<p>K8. Management and economics principles relevant to computing and information disciplines. Professional, moral and ethical issues involved in the exploitation of</p>	<p>A8. Modeling organizational processes and data, defining and implementing technical and process solutions, managing projects, and integrating systems</p>
a17. Define the methods used in defining and assessing criteria for measuring the extent to which an information system is appropriate for its current deployment and future evolution.	K4	A6		
a18. Describe the current and underlying technologies that support computer processing and inter-computer communication.	K8	A3	<p>K9. computer technology and be guided by the appropriate professional,</p> <p>K10. Ethical and legal practices relevant to the computing and information industry.</p> <p>K11. Requirements, practical constraints and computer-based systems</p>	<p>A9. Types and alternatives of global information systems architectures, and their differences in terms of service and cost consequences, and their implications for the organizational support needed.</p>

<b>Bioinformatics Program ILOs</b>	<b>Corresponding in NARS</b>	<b>NARS ILOs - General</b>	<b>NARS ILOs - Special</b>
A19. Discuss developments in research fields across a range of knowledge areas.	K3		

### **Academic Standards (Intellectual Skills) Bioinformatics**

<b>Bioinformatics ILOs</b>	<b>Corresponding in NARS</b>		<b>NARS ILOs - General</b>	<b>NARS ILOs - Special</b>
b1. Define traditional and nontraditional information systems problems, set goals towards solving them, and observe results.	I2	B1	<p>I1. Analyze computing problems and provide solutions related to the design and construction of computing systems.</p> <p>I2. Realize the concepts, principles, theories and practices behind computing and information as an academic discipline.</p> <p>I3. Identify criteria to measure and interpret the appropriateness of a computer system for its current deployment</p>	<p>B1. Define traditional and nontraditional information systems problems, set goals towards solving them, and observe results.</p> <p>B2. Perform comparisons between (methods, techniques...etc).</p> <p>B3. Identify attributes, components, relationships, patterns, main ideas, and errors.</p> <p>B4. Restrict solution methodologies upon their results.</p>
b2. Perform comparisons between (methods, techniques...etc).	I3	B2		
b3. Identify attributes, components, relationships, patterns, main ideas, and errors.	I2	B3		
b4. Summarize the proposed solutions and their results.	I4	B4		
b5. Restrict solution methodologies upon their results.	I5	B4		
b6. Establish criteria, and verify solutions.	I4	B5		
b7. Identify a range of solutions and critically evaluate and justify proposed design solutions.	I5	B7		
b8. Solve information systems problems with pressing commercial or industrial constraints.	I5	B8		
b9. Generate an innovative design to solve a problem containing a range of commercial and industrial constraints.	I6	B9		
b10. Perform problem analysis from written descriptions;	I6	B9		
b11. Derive requirements specifications from an understanding of problems (analysis, synthesis).	I6	B9		
b12. Create and/or justify designs to satisfy given requirements (synthesis, evaluation, application).	I6, I7	B9		
b13. Solve a decision model with appropriate techniques.	I8	B8		
b14. Solve complex problems within and between enterprises.	I1	B8		
b15. Perform improvement of a system that benefits stakeholders.	I9	B6		



<p>b16. Recognize the professional, moral and ethical issues involved in the exploitation of Information Technology and be guided by their adoption, reflect on issues of professional practice within the discipline.</p>	<p>I9</p>	<p>-</p>	<p>and future evolution.</p>	<p>B5. Select the suitable tools, methods and techniques for modeling, analyzing IS, establishing criteria, and verify solutions.</p>
<p>b17. Apply the concepts, principles, theories and practices underpinning computing as an academic discipline.</p>	<p>I2</p>	<p></p>	<p>I4. Analyze, propose and evaluate alternative computer systems and processes taking into account limitations, and quality constraints.</p>	<p></p>
<p>b18. Synthesize ideas, proposals and designs effectively using rational and reasoned arguments for presentation to a range of audiences.</p>	<p>I4</p>	<p>B7</p>	<p></p>	<p>B6. Identify a range of solutions and critically evaluate and justify proposed design solutions.</p>
<p>b19. Generate and evaluate the results of tests to investigate the functionality of information systems.</p>	<p>I7</p>	<p>B7</p>	<p>I5. Make ideas, proposals and designs using rational and reasoned arguments for presentation of computing systems.</p> <p>I6. Evaluate the results of tests to investigate the functionality of computer systems.</p> <p>I7. Achieve judgments considering balanced costs, benefits, safety, quality, reliability, and</p>	<p>B7. Solve IS problems with pressing commercial, time, and industrial constraints.</p> <p>B8. Suggest an innovative design to solve a problem containing a range of commercial and industrial constraints.</p>

			<p>environmental impact.</p> <p>I8.Familiar with the professional, legal, moral and ethical issues relevant to the computing industry.</p> <p>I9.Evaluate research papers in a range of knowledge areas</p>	<p>B9. Perform problem analysis from written descriptions; derive requirements specifications from an understanding of problems (analysis, synthesis).</p>
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## Academic Standards (Professional and Practical Skills) Bioinformatics

Bioinformatics Program ILOs	Corresponding in NARS		NARS ILOs - General	NARS ILOs - Special
c1. Use appropriate programming languages.	P2	C1	P1. Operate computing equipment, recognizing its logical and physical properties, capabilities and limitations.	C1. Use appropriate programming languages, web-based systems and tools, design methodologies, and database systems.
c2. Use appropriate web-based systems and tools, and design methodologies.	P2	C1		
c3. Use appropriate database management systems.	P2	C1		
c4. Apply the principles of effective information management, information organization, and information-retrieval skills to information of various kinds, including text, images, sound, and video.	P3	C2, C4, C6, C7	P2. Implement comprehensive computing knowledge and skills in projects and in deployment of computers to solve position practical problems.	C2. Use quantitative analysis techniques appropriately.
c5. 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.	P3	C8	P3. Deploy the equipment and tools used for the construction, maintenance and documentation of computer applications.	C3. Justify technological, methodological and management choices for an information system project for a given organization.
c6. Identify any risks or safety aspects that may be involved within a given context.	P7	C3, C9		C4. Plan and manage an information systems project from inception to final implementation cut-over.
c7. 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.	P5	C5, C10	P4. Apply computing information retrieval skills in computing community environment and industry.	C5. Produce acceptable reports and technical and user system documentation.
c8. Implement data and model centered systems.	P8	C2, C10	P5. Develop a range of fundamental research skills, through the use of online resources, technical repositories	C6. Perform information acquisition and management, using the scientific literature and web sources.
c9. Operate computing equipment effectively, recognizing its logical and physical properties, capabilities and limitations.	P1	C10, C11		C7. Apply the principles of effective information acquisition, information

<p>c10. Commercialize knowledge and skills to computing community and industry.</p>	<p>P7</p>	<p>C6, C11</p>	<p>and library-based material.</p> <p>P6.Design, implement, maintain, and manage software systems.</p> <p>P7.Assess the implications, risks or safety aspects involved in the operation of computing equipment within a specific context.</p> <p>P8.Handle a mass of diverse data, assess risk and draw conclusions.</p>	<p>management, organization, and information-retrieval to text, images, sound, and video.</p> <p>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.</p> <p>C9. Using tools to automate IS development phases.</p> <p>C10. Analyze and documenting the feasibility of various options and comparing solution concepts. Maintaining existing information systems.</p>
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## Academic Standards (Transferable Skills) Bioinformatics

Bioinformatics Program ILOs	Corresponding in NARS	NARS ILOs - General	NARS ILOs - Special
d1. Collaborate effectively within multidisciplinary team.	T2, P4	<p>T1.Demonstrate the ability to make use of a range of learning resources and to manage one's own learning.</p> <p>T2.Demonstrate skills in group working, team management, time management and organizational skills.</p> <p>T3.Show the use of information-retrieval.</p> <p>T4.Use an appropriate mix of tools and aids in preparing and presenting reports for a range of audiences, including management, technical, users, industry or the academic community.</p> <p>T5.Exhibit appropriate numeracy skills in understanding and presenting cases involving a quantitative dimension.</p>	-
d2. Work in stressful environment and within constraints.	T3		
d3. Communicate effectively using a variety of communication methods.	T6		
d4. Communicate effectively with team members, managers and customers.	T7		
d5. Demonstrate efficient IT capabilities.	T2		
d6. Lead and motivate individuals.	T4		
d7. Manage tasks and resources.	T9		
d8. Search for information and adopt life-long self-learning.			
d9. Acquire entrepreneurial skills.			
d10. Acquire analytical thinking and problem solving skills			
d11. Effectively employ information-retrieval skills, (including the use of browsers, search engines, and on-line library catalogues).	T3		
d12. Ability to work independently and as part of a team with minimum guidance.	P4		
d13. Manage one's own learning and development, including time management and organizational skills.	T1		
d14. Prepare their work in the form of reports, oral presentations or an internet web site.			
d15. Exhibit appropriate numeracy skills in understanding and	T5		

<p>presenting cases involving a quantitative dimension.</p>				
<p>d16. Develop a range of fundamental research skills, through the use of online resources, technical repositories and library-based material.</p>	<p>T8</p>		<p>T6.Reveal communication skills, public speaking and presentation skills, and delegation, writing skills, oral delivery, and effectively using various media for a variety of audiences.</p> <p>T7.Show the use of general computing facilities.</p> <p>T8.Demonstrate an appreciation of the need to continue professional development in recognition of the requirement for life-long learning.</p>	<p>-</p>

## Academic Standards Matrix

Knowledge and Understanding Skills				Intellectual Skills			
NARS ILOs General	Covering ILOs in IS Program	NARS ILOs Special	Covering ILOs in IS Program	NARS ILOs General	Covering ILOs in IS Program	NARS ILOs Special	Covering ILOs in IS Program
<b>K1</b>	a1, a2, a3, a10	<b>A1</b>	a1	<b>I1</b>	b14	<b>B1</b>	b1
<b>K2</b>	a4, a5, a16	<b>A2</b>	a2, a12	<b>I2</b>	b1, b17	<b>B2</b>	b2
<b>K3</b>	a6, a7, a17	<b>A3</b>	a3,a4,a6,a7,a9,a10,a14, a19	<b>I3</b>	b2, b3	<b>B3</b>	b3
<b>K4</b>	a8, a18	<b>A4</b>	a5	<b>I4</b>	b4, b6	<b>B4</b>	b4,b5
<b>K5</b>	a11, a14	<b>A5</b>	a12	<b>I5</b>	b5, b7, b8	<b>B5</b>	b6
<b>K6</b>	a12	<b>A6</b>	a8,a18	<b>I6</b>	b9, b10, b11, b12, b18	<b>B6</b>	b15
<b>K7</b>	a9	<b>A7</b>	a16	<b>I7</b>	b12, b19	<b>B7</b>	b7,b18,b19
<b>K8</b>	a13, a15, a19	<b>A8</b>	a13,a15,a17	<b>I8</b>	b13	<b>B8</b>	b8, b13,b14
		<b>A9</b>	a11	<b>I9</b>	b16	<b>B9</b>	b9,b11,b12
				<b>I10</b>	b15		

  

Professional and Practical Skills				Transferable skills	
NARS ILOs General	Covering ILOs in IS Program	NARS ILOs Special	Covering ILOs in IS Program	NARS ILOs General	Covering ILOs in IS Program
<b>P1</b>	c9	<b>C1</b>	c1, c2, c3	<b>T1</b>	d6, d13
<b>P2</b>	c1, c2, c3	<b>C2</b>	c4,c8	<b>T2</b>	d5
<b>P3</b>	c5	<b>C3</b>	c6	<b>T3</b>	d11
<b>P4</b>	d1, d12	<b>C4</b>	c4	<b>T4</b>	d2
<b>P5</b>	c7	<b>C5</b>	c7	<b>T5</b>	d15
<b>P6</b>	c4	<b>C6</b>	c4,c10	<b>T6</b>	d3
<b>P7</b>	c6, c10	<b>C7</b>	c4	<b>T7</b>	d4
		<b>C8</b>	c5	<b>T8</b>	d16
		<b>C9</b>	c6	<b>T9</b>	d7
		<b>C10</b>	c8, c9		
		<b>C11</b>	c9,c10		













BNF415	Bioinformatics Capstone Project I	√	√	√	√	√	√											√	√	√	√	√	
BNF416	Bioinformatics Capstone Project II	√	√	√	√	√	√											√	√	√	√	√	√
IS441	Quality Assurance of Information Systems	√	√	√	√	√	√																
IS442	IS Application Development	√	√	√	√	√	√																
BNF414	Biological Databases	√	√	√	√	√	√																

### Program MatrixV (Courses - Professional and Practical Skills)

Code	Course	c1	c2	c3	c4	c5	c6	c7	c8	c9	c10
HUM111	English Language I	√	√	√							
HUM121	Social Context of Computing	√	√	√							
HUM132	Interpersonal Communication	√	√	√							
HUM231	Business Administration	√	√	√							
HUM232	Technical Writing	√	√	√							
HUM241	Computers and Ethics	√	√	√							
MATH101	Mathematics I	√	√	√							
MATH102	Mathematics I I	√	√	√	√						
MATH202	Probability and Statistics	√	√	√	√						
MATH201	Mathematics III	√	√	√	√						
PHYS101	Physics I	√	√	√	√	√	√				
PHYS102	Introduction to Biophysics				√	√				√	
BIO101	Introduction to Biology	√	√	√	√	√	√				
BOT301	Introduction to Molecular Cell Biology	√	√	√	√	√	√				
CHEM201	Introduction to BioChemistry						√	√	√	√	
EE101	Electronics						√	√	√	√	
EE102	Digital Circuits						√	√	√	√	











Intended Learning Outcomes (ILO's) of the program		Teaching and Learning Methods					
		Lecture	Tutorials exercises	Practical exercises	Workshops	Projects	Case study
Knowledge and Understanding	<b>By the end of the program, student should be able to:</b>						
	a1. Demonstrate basic knowledge and understanding of a core of analysis, algebra, applied mathematics and statistics	<input type="checkbox"/>	<input type="checkbox"/>				
	a2. Demonstrate strong knowledge of information systems.	<input type="checkbox"/>		<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>
	a3. Demonstrate strong skills of database management systems.	<input type="checkbox"/>		<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>
	a4. Describe the principles and techniques of a number of application areas informed by the research directions of information systems.	<input type="checkbox"/>		<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>
	a5. Explain the broad context within which information systems including issues such as quality and reliability.	<input type="checkbox"/>					
	a6. Identify information systems applications, such as accounting, health informatics, medical informatics, etc.	<input type="checkbox"/>		<input type="checkbox"/>		<input type="checkbox"/>	
	a7. Identify selected specialist fields at the forefront of information systems.	<input type="checkbox"/>					
	a8. Discuss the principles of Information communication and information security.	<input type="checkbox"/>		<input type="checkbox"/>			
	a9. Describe the challenges inherent in the maintenance and evolution of software systems, and the techniques and best practices currently available for dealing with them.	<input type="checkbox"/>					
	a10. Discuss some aspects of object-oriented analysis and design.	<input type="checkbox"/>		<input type="checkbox"/>			
	a11. Explain decision support tools and systems.	<input type="checkbox"/>		<input type="checkbox"/>			
	a12. Identify various approaches to Management Sciences (MS) such as Operation Management, Inventory Management, Project Management, and Supply Chain Management.	<input type="checkbox"/>		<input type="checkbox"/>		<input type="checkbox"/>	
	a13. Interpret and analyze data qualitatively and/or quantitatively.	<input type="checkbox"/>		<input type="checkbox"/>		<input type="checkbox"/>	
	a14. Demonstrate strong knowledge of fundamentals of programming and the construction of computer-based systems, data structures and algorithms, software engineering techniques and information retrieval.	<input type="checkbox"/>		<input type="checkbox"/>			
	a15. Demonstrate a deep knowledge of business area analysis and the enterprise architecture.	<input type="checkbox"/>		<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>
	a16. Define the tools, practices and methodologies used in the specification, design, implementation and critical evaluation of computer and information systems.	<input type="checkbox"/>					

Intended Learning Outcomes (ILO's) of the program		Teaching and Learning Methods						
		Lecture	Tutorials exercises	Practical exercises	Workshops	Projects	Case study	Data collection
	a17. Define the methods used in defining and assessing criteria for measuring the extent to which an information system is appropriate for its current deployment and future evolution.	<input type="checkbox"/>						
	a18. Describe the current and underlying technologies that support computer processing and inter-computer communication.	<input type="checkbox"/>						
	a19. Discuss developments in research fields across a range of knowledge areas.	<input type="checkbox"/>				<input type="checkbox"/>		
Intellectual Skills	b1. Define traditional and nontraditional information systems problems, set goals towards solving them, and observe results.	<input type="checkbox"/>						
	b2. Perform comparisons between (methods, techniques...etc).	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	b3. Identify attributes, components, relationships, patterns, main ideas, and errors.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>		
	b4. Summarize the proposed solutions and their results.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>	
	b5. Restrict solution methodologies upon their results.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>		
	b6. Establish criteria, and verify solutions.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>		
	b7. Identify a range of solutions and critically evaluate and justify proposed design solutions.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>		
	b8. Solve information systems problems with pressing commercial or industrial constraints.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>		
	b9. Generate an innovative design to solve a problem containing a range of commercial and industrial constraints.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>		
	b10. Perform problem analysis from written descriptions	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>		
	b11. Derive requirements specifications from an understanding of problems (analysis, synthesis).	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>		
	b12. Create and/or justify designs to satisfy given requirements (synthesis, evaluation, application).	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>		
	b13. Solve a decision model with appropriate techniques.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>		
	b14. Solve complex problems within and between enterprises.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>	
	b15. Perform improvement of a system that benefits stakeholders.	<input type="checkbox"/>		<input type="checkbox"/>				
	b16. Recognize the professional, moral and ethical issues involved in the exploitation of Information Technology and be guided by their adoption, reflect on issues of professional practice within the discipline.	<input type="checkbox"/>						

Intended Learning Outcomes (ILO's) of the program		Teaching and Learning Methods						
		Lecture	Tutorials exercises	Practical exercises	Workshops	Projects	Case study	Data collection
	b17. Apply the concepts, principles, theories and practices underpinning computing as an academic discipline.	<input type="checkbox"/>						
	b18. Synthesize ideas, proposals and designs effectively using rational and reasoned arguments for presentation to a range of audiences.	<input type="checkbox"/>		<input type="checkbox"/>				
	b19. Generate and evaluate the results of tests to investigate the functionality of information systems.			<input type="checkbox"/>		<input type="checkbox"/>		
Professional Skills	c1. Use appropriate programming languages.	<input type="checkbox"/>		<input type="checkbox"/>		<input type="checkbox"/>		
	c2. Use appropriate web-based systems and tools, and design methodologies.	<input type="checkbox"/>		<input type="checkbox"/>		<input type="checkbox"/>		
	c3. Use appropriate database management systems.	<input type="checkbox"/>		<input type="checkbox"/>		<input type="checkbox"/>		
	c4. Apply the principles of effective information management, information organization, and information-retrieval skills to information of various kinds, including text, images, sound, and video.	<input type="checkbox"/>		<input type="checkbox"/>		<input type="checkbox"/>		
	c5. 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.	<input type="checkbox"/>		<input type="checkbox"/>		<input type="checkbox"/>		
	c6. Identify any risks or safety aspects that may be involved within a given context.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>		
	c7. 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.	<input type="checkbox"/>		<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>	
	c8. Implement data and model centered systems.	<input type="checkbox"/>		<input type="checkbox"/>		<input type="checkbox"/>		
	c9. Operate computing equipment effectively, recognizing its logical and physical properties, capabilities and limitations.					<input type="checkbox"/>		
	c10. Commercialize knowledge and skills to computing community and industry.					<input type="checkbox"/>		
General Skills	d1. Collaborate effectively within multidisciplinary team.			<input type="checkbox"/>		<input type="checkbox"/>		
	d2. Work in stressful environment and within constraints.			<input type="checkbox"/>		<input type="checkbox"/>		
	d3. Communicate effectively using a variety of communication methods.			<input type="checkbox"/>		<input type="checkbox"/>		
	d4. Communicate effectively with team members, managers and customers.	<input type="checkbox"/>		<input type="checkbox"/>		<input type="checkbox"/>		<input type="checkbox"/>

Intended Learning Outcomes (ILO's) of the program	Teaching and Learning Methods						
	Lecture	Tutorials exercises	Practical exercises	Workshops	Projects	Case study	Data collection
d5. Demonstrate efficient IT capabilities.			<input type="checkbox"/>		<input type="checkbox"/>		
d6. Lead and motivate individuals.			<input type="checkbox"/>		<input type="checkbox"/>		
d7. Manage tasks and resources.			<input type="checkbox"/>		<input type="checkbox"/>		
d8. Search for information and adopt life-long self-learning.	<input type="checkbox"/>		<input type="checkbox"/>		<input type="checkbox"/>		
d9. Acquire entrepreneurial skills.			<input type="checkbox"/>				
d10. Acquire analytical thinking and problem solving skills	<input type="checkbox"/>		<input type="checkbox"/>		<input type="checkbox"/>		
d11. Effectively employ information-retrieval skills, (including the use of browsers, search engines, and on-line library catalogues).	<input type="checkbox"/>		<input type="checkbox"/>				
d12. Ability to work independently and as part of a team with minimum guidance.			<input type="checkbox"/>		<input type="checkbox"/>		
d13. Manage one's own learning and development, including time management and organizational skills.			<input type="checkbox"/>		<input type="checkbox"/>		
d14. Prepare their work in the form of reports, oral presentations or an internet web site.	<input type="checkbox"/>		<input type="checkbox"/>		<input type="checkbox"/>		
d15. Exhibit appropriate numeracy skills in understanding and presenting cases involving a quantitative dimension.					<input type="checkbox"/>		
d16. Develop a range of fundamental research skills, through the use of online resources, technical repositories and library-based material.	<input type="checkbox"/>		<input type="checkbox"/>		<input type="checkbox"/>		

**Program Coordinator:** Prof. Dr. Taysir Hassan Abdel Hamid

**Signature:**

**Approved by the Dean:** Prof. Dr. Taysir Hassan Abdel Hamid

**Signature:**

