ASSIUT UNIVERSITY

Faculty of Computers and Information
Department of Information Systems

Bioinformatics

Master Program

2021

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Assiut University

Faculty of Computers & Information

2021-2022

Bioinformatics Master Program

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Program Specifications

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

Bioinformatics Master Program Specifications 2021-2022

A. Basic Information

1. **Program Title:** Master's in computers and information (Bioinformatics)
2. **Program Type:** Single
3. **Faculty (Faculties):** Faculty of Computers and Information
4. **Department:** Bioinformatics
5. **Assistant Coordinator:**
6. **Coordinator: Prof.** Dr. Taysir Hassan A. Soliman
7. **Last date of program specifications approval: 1/9/2021**

B. Professional Information

1. Program Aims and Objectives

Successfully completing this program will contribute to some certain graduate attributes. Specifically, a graduate of Computers and Information (Information Systems) Master Program should be able to:

I. Be proficient in applying scientific research basics and methodologies and using its various tools in information systems.
II. Apply analytical methodologies and use them in Bioinformatics domains.
III. Apply specialized knowledge in Bioinformatics and merge it with other related knowledge of his/her professional practice.
IV. Be aware of current problems and vision of Bioinformatics.
V. Determine professional problems and find solutions for them.
VI. Master a suitable level of professional skills in Bioinformatics and use appropriate technology in his/her professional practices.
VII. Communicate effectively at work.
VIII. Lead team work and take decisions at different professional scenarios.
IX. Employ available resources efficiently to preserve them and maximize their utilization.
X. Show his/her awareness in community developing and preserving the environment according to the local and global changes.
XI. Act with integrity, credibility and applying the rules of the profession.
XII. Develop his/her professional and academic skills, and adopt life-long self-learning.
XIII. Apply critical thinking to a particular challenge that might be experienced in a professional setting.
XIV. Improve the efficiency and effectiveness of any organization by organizing information related to bioinformatics domain.

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2. Intended Learning Outcomes (ILOs)

a. Knowledge and Understanding

After completing the Master program in Computers and Information (Bioinformatics), the graduate should be able to know and understand the following:

A1. Identify theories and fundamentals in bioinformatics, concepts of biology, computer science and mathematics and related domains.
A2. Define effective exchange between professional practices and their reflection on the environment.
A3. Discuss scientific development in bioinformatics.
A4. Explain ethical and legal principles for professional practice in information systems.
A5. Identify quality principles of professional practice in information systems.
A6. Define the fundamentals of scientific research and its ethics.
A7. Identify role of bioinformatics in organizations.
A8. Identify the intersection of life and information sciences, the core of shared concepts, language and skills the ability to speak the language of structure-function relationships, information theory, gene expression, and database queries.
A9. Acquire the obligations of bioinformatics in the society

b. Intellectual Skills

On successful completion of this program, graduates should be able to:
b1. Analyze and evaluate the information in bioinformatics domain and its applications
b2. Solve specialized problems without enough inputs, , including the ability to develop new algorithms and analysis methods
b3. Link different knowledge to solve professional problems.
b4. Carry out a research study and write a thesis around a research problem in information systems.
b5. Assess risks in professional practice of Bioinformatics.
b6. Plan to develop the performance in Bioinformatics.
b7. Take professional decisions in different scenarios.
b8. Specify and design intelligent and traditional computer-based systems, using formal design procedures where appropriate.
b9. Extract information from large databases

c. Professional and Practical Skills

On successful completion of this program, graduates should be able to:
c1. Master basic and modern professional skills.
c2. Write and evaluate professional reports.
c3. Evaluate the strengths and weaknesses of particular solutions in bioinformatics.
c4. Apply evidence and make evidence-based decisions
c5. Deal with bioinformatics ethical problems

d. General and Transferable Skills

On successful completion of this program, graduates should be able to:
d1. Communicate efficiently by different means.
d2. Use the information technology to serve the professional practice.
d3. Have self-assessment and identification of personal learning needs.

d4. Use different recourses to obtain information and knowledge.
d5. Propose roles and indicators to evaluate the performance of the others.
d6. Work in a team and lead teams in different professional tracks.
d7. Manage time efficiently.
d8. Long-life self-learning.
d9. Synthesize ideas from multiple sources.
d10. Develop an argument in a coherent and logical manner

3. Academic Standards

The academic standards invoked in this specification are driven from a number of resources:

a. The generic standards in the "Guide of Academic Standards for Graduate Programs" published by the National Authority for Quality Assurance & Accreditation (NAQAAE) on March 2009.
b. Nile University, Egypt, M.Sc. Bioinformatics program.
c. Johns Hopkins University, USA, MS of Bioinformatics.

4. Curriculum Structure and Contents

4a. Program duration: at least 2 years.
4b. Program structure
- No. of hours per week: Lectures (6),   Lab./Tut. (0), Total (10)
- No. of credit hours: Compulsory (6), Elective (12), seminar (2), thesis (16)
- No. of hours of basic computing: 6 credits, 40%
- No. of hours of specialized information systems courses: 12 credits, 60%
- Field Training: Not compulsory
- Program Levels (in credit-hours system): Not applicable.

5. Program Courses

5a. Compulsory Courses

Course Code / No.	Course Title	Units No	No. of hours /week			Year	Semester	Achieved ILOs
			Lect	Lab	Exer			
IS600	Big Data Management	3	2	–	–	1st	1st + 2nd	a1, a3, a5, b1, b3, b4, b5, b6, b8, b9, c1, c3, c5, d2, d4, d9
IS601	Research Methodologies	3	2	–	–	1st	1st + 2nd	a1, a3, a6, b1, b2, b3, b4, b6, b9, c1, c2, c4, d2, d3, d8, d9
T O T A L		6	4	–	–			

5b. Elective Courses

Course Code / No.	Course Title	Units No	No. of hours /week			Year	Semester	Achieved ILOs
			Lect.	Lab	Exer.			
1	Elective Course I	3	2	–	–	1st	1st + 2nd	a1, a2, a3, a5, a6, a7, a8, a9, b1, b2, b3, b5, b6, b7, c1, c3, c5, d1, d2, d4, d8
2	Elective Course II	3	2	–	–	1st	1st + 2nd	a1, a2, a3, a5, a6, b1, b2, b3, b5, b6, b7, c1, c3, c5, d1, d2, d4, d8, d9, d10
3	Elective Course III	3	2	-	-	1st	1st + 2nd	a1, a2, a4, a6, a8, b1, b3, b6, b7, c1, c2, c4, d1, d4, d8, d10
4	Elective Course IV	3	2	-	-	1st	1st + 2nd	a2, a4, a5, a6, a8, b2, b3, b5, b6, b7, b8, b9, c2, c3, c5, d1, d2, d4, d6, d8, d9
T O T A L		12	8	–	–			

Elective Courses	
Course Code	Course Title
BNF600	Advanced Topics in Computational Biology
BNF601	Biological Data Mining
BNF602	Drug Discovery in Bioinformatics
BNF603	Systems Biology
BNF604	Research Seminars in Bioinformatics
BNF605	Biostatistics
IS602	Big Data Analytics
IS605	Algorithms for Data Science
IS607	Information Visualization
IS610	Semantic Data Integration
CS600	Advanced Topics in Machine Learning
CS603	Grid and Cloud Computing
CS606	Natural Language Processing
CS610	Deep Learning

5c. Seminar

Course Code / No.	Course Title	Units No	No. of hours /week			Year	Semester	Achieved ILOs
			Lect	Lab	Exer			
	Seminar	2	2	–	–	1st	2nd	a1, a2, a3, a5, a6, a7, a8, b1, b3, b4, b5, b6, b8, c1, c2, c3, d2, d3, d4, d5, d6, d7, d8, d9
T O T A L		2	2	–	–			

5d. Master Thesis

No.	Title	Units No	Year	Semester	Achieved ILOs
1	Master Thesis	16	2nd	1st + 2nd	a1, a2, a3, a4, a5, a6, b1, b2, b3, b4, b5, b6, b7, c1, c2, c3, d2, d3, d4, d5, d5, d6, d7, d8, d9

6. Contents of Courses
Syllabus: See below

7. Program Admission Requirements
High score in secondary school education certificate in (mathematics & Science sections).

8. Regulations for progression and program completion
Please, refer to faculty bylaw (curriculum of undergraduate programs), 2021.

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9. 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 - General Skills
3- Thesis	Knowledge and Understanding - Intellectual Skills - Professional Skills - General Skills

10. Program Evaluation

Evaluator	Tool	Sample
1- Senior students		
2- Alumni		
3- Stakeholders		
4-External Evaluator(s) (External Examiner(s))		
5- Other		

Program Coordinator: Prof. Dr. Taysir Hassan Abdel Hamid

Signature:

Date: 1/9/2021

Department Head: Prof. Dr. Taysir Hassan Abdel Hamid

Signature:

Date: 1/9/2021

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

Signature:

Date: 20/9/2021

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Program
Matrix

IS Master Program Matrices

Program ILOs		a1	a2	a3	a4	a5	a6	a7	a8	a9	b1	b2	b3	b4	b5	b6	b7	b8	b9	c1	c2	c3	c4	c5	d1	d2	d3	d4	d5	d6	d7	d8	d9	d10
Courses and Thesis	IS600	✓		✓		✓					✓		✓	✓	✓	✓		✓	✓	✓		✓		✓		✓		✓					✓	
	IS601	✓		✓			✓				✓	✓	✓	✓		✓			✓	✓	✓		✓			✓	✓					✓	✓	
	EL1	✓	✓	✓		✓	✓	✓	✓	✓	✓	✓	✓		✓	✓	✓				✓		✓	✓	✓	✓		✓				✓		
	EL2	✓	✓	✓		✓	✓				✓	✓	✓		✓	✓	✓				✓		✓	✓	✓	✓		✓				✓	✓	✓
	EL3	✓	✓		✓		✓		✓		✓		✓							✓	✓		✓			✓		✓				✓		✓
	EL4		✓		✓	✓	✓		✓			✓	✓		✓	✓	✓				✓	✓		✓	✓	✓		✓		✓		✓	✓	
	Seminar	✓	✓	✓		✓	✓	✓	✓		✓		✓	✓	✓	✓		✓		✓	✓	✓				✓	✓	✓	✓	✓	✓	✓	✓	
	Master Thesis	✓	✓	✓	✓	✓					✓	✓	✓	✓	✓	✓				✓	✓	✓			✓	✓	✓	✓	✓	✓	✓	✓	✓	✓

Bioinformatics Master's Program

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Courses Specifications
2021- 2022

Course Specifications

Relevant program	Master in Computers and Information(Bioinformatics)
Department offers the program	Bioinformatics
Department offers the course	Bioinformatics
Academic year	1st Year
Date of specification approval	1/9/2021

A. Basic Information

1. **Course Title:** Research Methodologies
2. **Course Code:** IS601
3. **Course hours per week:**

Lecture	Tutorial / Practical	Total
2	–	2

B. Professional Information

1. Overall aims of the course

Upon completing this course, the student will be able to:
- Understanding Research Design and Methods.
- Developing Critical Analysis Skills.
- Ethical Considerations in Research.
- Communicating Research Findings.

2. Intended Learning Outcomes (ILOs) of the course

a. Knowledge and Understanding

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

a1. Identify theories and fundamentals in bioinformatics, concepts of biology, computer science and mathematics and related domains.

a3. Discuss scientific development in bioinformatics.

a6. Define the fundamentals of scientific research and its ethics.

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b. Intellectual Skills

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

b1. Analyze and evaluate the information in bioinformatics domain and its applications

b2. Solve specialized problems without enough inputs, including the ability to develop new algorithms and analysis methods

b3. Link different knowledge to solve professional problems.

b4. Carry out a research study and write a thesis around a research problem in Bioinformatics.

b6. Plan to develop the performance in Bioinformatics.

b9. Extract information from large databases.

c. Professional and Practical Skills

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

c1. Master basic and modern professional skills.

c2. Write and evaluate professional reports.

c1. Apply evidence and make evidence-based decisions.

d. General and Transferable Skills

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

d2. Use information technology to serve professional practice.

d3. Have self-assessment and identification of personal learning needs.

d8. Practice Long-life self-learning.

d9. Synthesize ideas from multiple sources.

Contents

N o	Topic taught	No. of hours		ILOs
		Lecture	Tut/Prac	
1	Understanding Research Design and Methods	8h	--	a1, a3, a6, b1, c1
2	Developing Critical Analysis Skills	6h	--	b1, b2, b3, b6, d9
3	Ethical Considerations in Research	4h	--	a6, c2
4	Communicating Research Findings	8h	--	c2, d2, d9

3. Teaching and Learning Methods

4a. Lectures

4b. Tutorial Exercises

4c. Projects

4. Student Assessment

5a. Tools

Final Exam	To measure knowledge, understanding, intellectual professional and general skills.
Projects	To measure professional and general skills

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5b. Time Schedule

Assessment	Week No
Final Exam	13

5c. Grading System

Assessment	Grade %
Final Exam	70%
Year Work	30%

5d. Formative Assessment

Regular quizzes distributed along the whole semester.

5. List of References

6a. Course Notes
- Short course notes available at the course homepage.

6b. Required Books (Textbooks)
- Yogesh Kumar Singh, *Fundamental of Research Methodology and Statistics*, 2020, MKCL.

6c. Recommended Books
- Uma Sekaran and Roger Bougie, Research Methods for Business: A Skill-Building Approach, 2020, Wiley.

6d. Web Sites
- Course homepage is accessed from the FCI website: http://www.aun.edu.eg/Courses/

6. Facilities Required for Teaching and Learning

- A lecture hall equipped with projectors and computers.
- Labs equipped with computers and Internet facilities.
- A library.

Course Coordinator: Prof.Dr. Taysir H. Abdel-Hamid

Signature:

Date: 1/9/2021

Department Head: Prof.Dr. Taysir H. Abdel-Hamid

Signature:

Date: 1/9/2021

Course Matrix

Course Name	Research Methodologies	Course Code: IS601

No	Course Content	Teaching Weeks	ILOs				Teaching and Learning Methods	Assessment Tools	Criteria
			a's	b's	c's	d's	Lectures	Final Exam & Year Work	
1	Understanding Research Design and Methods.	8	1,3	1,3	1,2	2,3	✓	✓	**Student evaluation, course file, exam results**
2	Developing Critical Analysis Skills.	6	1,6	1,2	1,2	2,8	✓	✓	
3	Ethical Considerations in Research.	6	3,6	1,4	1,4	8,9	✓	✓	
4	Communicating Research Findings	3	1,3	6	2	2,3	✓	✓	
5	Case Study	2	6	9	4	8,9	✓	✓	

Course Coordinator	Prof.Dr. Taysir H. Abdel-Hamid	Department Head	Prof.Dr. Taysir H. Abdel-Hamid

Course Specifications

Relevant program	Master in Computers and Information(Bioinformatics)
Department offers the program	Bioinformatics
Department offers the course	Bioinformatics
Academic year	1st Year
Date of specification approval	1/9/2021

A. Basic Information

1. **Course Title:** Elective Course I (Algorithms for Data Science)
2. **Course Code:** IS605
3. **Course hours per week:**

Lecture	Tutorial / Practical	Total
2	–	2

B. Professional Information

1. Overall aims of the course

Upon completing this course the student will be able to:

- Mastering Core Algorithms
- Applying Algorithms to Real-World Data.
- Analyzing Algorithm Efficiency.
- Integrating Algorithms with Data Science Tools.
- Fostering Innovation in Algorithm Design

2. Intended Learning Outcomes (ILOs) of the course

a. Knowledge and Understanding

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

a1. Identify theories and fundamentals in bioinformatics, concepts of biology, computer science and mathematics and related domains.

a2. Define effective exchange between professional practices and their reflection on the environment.

a3. Discuss scientific development in bioinformatics.

a5. Identify quality principles of professional practice in information systems.

a6. Define the fundamentals of scientific research and its ethics.

a7. Identify role of bioinformatics in organizations.

a8. Identify the intersection of life and information sciences, the core of shared concepts, language and skills the ability to speak the language of structure-function relationships, information theory, gene expression, and database queries.

a9. Acquire the obligations of bioinformatics in society.

b. **Intellectual Skills**

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

b1. Analyze and evaluate the information in bioinformatics domain and its applications

b2. Solve specialized problems without enough inputs, , including the ability to develop new algorithms and analysis methods

b3. Link different knowledge to solve professional problems.

b5. Assess risks in professional practice of Bioinformatics.

b6. Plan to develop the performance in Bioinformatics.

b7. Take professional decisions in different scenarios.

c. **Professional and Practical Skills**

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

c1. Master basic and modern professional skills.

c3. Evaluate the strengths and weaknesses of particular solutions in Bioinformatics.

c5. Deal with bioinformatics ethical problems.

d. **General and Transferable Skills**

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

d1. Communicate efficiently by different means.

d2. Use information technology to serve the professional practice.

d4. Use different recourses to obtain information and knowledge.

d8. Long-life self-learning.

3. Contents

No	Topic taught	No. of hours		ILOs
		Lecture	Tut/Prac	
1	Mastering Core Algorithms	8h	----	a1, a3, a7, c1, c3
2	Applying Algorithms to Real-World Data	6h	-----	a5, a7, b1, b2, b3, c1
3	Analyzing Algorithm Efficiency	6h	----	a6, b1, b5, b7, c3
4	Integrating Algorithms with Data Science Tools.	4h	----	a3, a5, d2, d4
5	Fostering Innovation in Algorithm Design	2h	----	b3, b6, d1, d8

4. Teaching and Learning Methods
4a. Lectures
4b. Tutorial Exercises
4c. Projects

5. Student Assessment
5a. Tools

Final Exam	To measure knowledge, understanding, intellectual professional and general skills.
Projects	To measure professional and general skills

5b. Time Schedule

Assessment	Week No
Final Exam	13

5c. Grading System

Assessment	Grade %
Final Exam	70%
Year Work	30%

5d. Formative Assessment
Regular quizzes distributed along the whole semester.

6. List of References
6a. Course Notes
  o   Short course notes available at the course homepage.
6b. Required Books (Textbooks)
  o   **Arthur K. Kordon**, *Algorithms for Data Science*, 2020, Springe.
6c. Recommended Books
  o   Jake VanderPlas, Python Data Science Handbook: Essential Tools for Working with Data, 2016, O'Reilly Media.
6d. Web Sites
  o   Course homepage is accessed from the FCI website:
      http://www.aun.edu.eg/Courses/

7. Facilities Required for Teaching and Learning

- A lecture hall equipped with projectors and computers.
- Labs equipped with computers and Internet facilities.
- A library.

Course Coordinator: Prof.Dr. Taysir H. Abdel-Hamid

Signature:

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Date: 1/9/2021

Department Head: Prof.Dr. Taysir H. Abdel-Hamid

Signature:

Date: 1/9/2021

Assiut University
Faculty of Computers & Information
Quality Assurance Unit

Course Matrix

Course Name   Elective Course I (Algorithms for Data Science)   Course Code: IS605

No	Course Content	Teaching Weeks	ILOs				Teaching and Learning Methods	Assessment Tools	Criteria
			a's	b's	c's	d's	Lectures	Final Exam & Year Work	
1	Mastering Core Algorithms	8	1-3	1-3	1,3	1-2	✓	✓	Student evaluation, course file, exam results
2	Applying Algorithms to Real-World Data	10	5-9	5-6	1,5	2,8	✓	✓	
3	Analyzing Algorithm Efficiency	6	6-8	6-7	3,5	4,8	✓	✓	

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4	Integrating Algorithms with Data Science Tools.	3	8-9	2-3	1,5	1-2	✓	✓
5	Fostering Innovation in Algorithm Design	4	1-2	5-7	3,5	1,4	✓	✓
6	Case Study	3	2-3	1-3	1,3	2,8	✓	✓

Course Coordinator	Prof.Dr. Taysir H. Abdel-Hamid	Department Head	Prof.Dr. Taysir H. Abdel-Hamid

Signature   **Signature**

Assiut University
Faculty of Computers & Information
Quality Assurance Unit

Course Specifications

Relevant program	Master in Computers and Information (Bioinformatics)
Department offers the program	Computer Science
Department offers the course	Computer Science
Academic year	1st Year
Date of specification approval	1/9/2021

A. Basic Information

1. **Course Title:** Elective Course II (Deep Learning)
2. **Course Code:** CS610
3. **Course hours per week:**

Lecture	Tutorial / Practical	Total
2	–	2

B. Professional Information

1. Overall aims of the course

Upon completing this course the student will have learned, through appropriate classroom and laboratory experiences, the following.

- Teach fundamental concepts and key architectures like CNNs, RNNs, and Transformers.
- Provide practical skills in implementing deep learning models using frameworks like TensorFlow and PyTorch.
- Apply deep learning to real-world problems in areas like computer vision and NLP.
- Develop model evaluation and tuning skills.
- Address limitations and ethical considerations of deep learning.
- Encourage engagement with current research and innovation in the field.

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2. Intended Learning Outcomes (ILOs) of the course

a. Knowledge and Understanding

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

a1. Explain theories and fundamentals in Computer Science and related domains.
a2. Interpret scientific development in Computer Science.
a3. Outline the quality principles of professional practice in Computer Science.
a4. Identify the fundamentals of scientific research and its ethics.
a5. Define the principles and techniques used in the design of parallelizing compilers on shared and distributed memory architectures.
a6. A deep and systematic understanding of the academic discipline of Computer Science.
a7. A critical awareness of current problems and research issues in selected areas of Computer Science.

b. Intellectual Skills

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

b1. Analyze and evaluate the information in the domain of Computer Science and take references from them for problem solving.
b2. Solve specialized problems without enough inputs.
b3. Link different knowledge to solve professional problems.
b4. Assess risks in professional practice of Computer Science.
b5. Plan to develop the performance in Computer Science.
b6. Establish techniques of research and enquiry are used to extend, create and interpret knowledge in Computer Science.
b7. Recognize the need for, and show an ability for, dealing with constantly changing technology and continuing professional development.

c. Professional and Practical Skills

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

c1. Master basic and modern professional skills in Computer Science.
c2. Evaluate current methods and tools in Computer Science.
c3. Compute dependencies in software programs and develop program representations suitable for parallelizing software.
c4. Deal with complex issues at the forefront of the academic discipline of Computer Science in a manner, based on sound judgments, that is both systematic and creative; and be able to communicate conclusions clearly to both specialists and non-specialists.
c5. An ability to consistently apply knowledge concerning current research issues in computer science in an original manner and produce work that is at the forefront of the developments in the domain of the program of study.
c6. Generate and apply appropriate solutions to solve problems based on reasoned rationale.

d. General and Transferable Skills

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

d1. Communicate efficiently by different means.
d2. Use the information technology to serve the professional practice.
d3. Use different recourses to obtain information and knowledge.

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d4. Long-life self-learning.

d5. Effectively present ideas, designs and solutions in a logical framework in a variety of forms with proper language structure and mechanics, and to produce appropriate written documentation.

3. Contents

No	Topic taught	No. of hours		ILOs
		Lecture	Tut/Prac	
1	**Neural Network Fundamentals:** Introduction to the basic building blocks of deep learning, including neurons, layers, activation functions, and backpropagation**.**	12	8	a1,a5,a7, b1,b2, c1,c6, d4,d5
2	**Convolutional Neural Networks (CNNs)**: Focus on deep learning architectures designed for processing and understanding image data.	9	8	a2,a3,a8 ,b3, b4, c2,c4, d2,d3
3	**Recurrent Neural Networks (RNNs) and LSTMs**: Study of models that handle sequential data, crucial for tasks like language modeling and time-series prediction.	12	8	a3,a8, b6,b7, c3,c5, d1
4	**Deep Learning Model Optimization**: Techniques for improving model performance, including hyperparameter tuning, regularization, and optimization algorithms.	12	8	a4,a6, b5,b7, c5,c6, d2,d5

4. Teaching and Learning Methods

4a. Lectures

4b. Tutorial Exercises

4c. Workshops

4d. Projects

5. Student Assessment

5e. Tools

Final Exam	To measure knowledge, understanding, intellectual professional and general skills.
Projects	To measure professional and general skills

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5f. Time Schedule

Assessment	Week No
Final Exam	15

5g. Grading System

Assessment	Grade %
Final Exam	70%
Year Work	30%

5h. Formative Assessment

Regular quizzes distributed along the whole semester.

6. List of References

6a. Course Notes

    a. Short course notes available at the course homepage.

6b. Required Books (Textbooks)

    a. Deep Learning" by Ian Goodfellow, Yoshua Bengio, and Aaron Courville.

6c. Recommended Books

    a. Neural Networks and Deep Learning: A Textbook" by Charu Aggarwal.

6d. Web Sites

    a. Course homepage is accessed from the FCI website:
       http://www.aun.edu.eg/Courses/

7. Facilities Required for Teaching and Learning

- A lecture hall equipped with projectors and computers.
- Labs equipped with computers and Internet facilities.
- A library.

Course Coordinator: Prof.Dr.Khaled Fathy

Signature:

Date: 1/9/2021

Department Head: Prof.Dr. Khaled Fathy

Signature:

Date: 1/9/2021

Assiut University
Faculty of Computers & Information
Quality Assurance Unit

Course Matrix

Course Name   Elective Course II (Deep Learning)   Course Code: CS610

No	Course Content	Teaching Weeks	ILOs				Teaching and Learning Methods	Assessment Tools	Criteria
			a's	b's	c's	d's	Lectures	Final Exam & Year Work	
1	**Neural Network Fundamentals:** Introduction to the basic building blocks of deep learning, including neurons, layers, activation functions, and backpropagation.	8	1-3	1-3	1-2	1-2	✓	✓	**Student evaluation, course file, exam results**

2	**Convolutional Neural Networks (CNNs)**: Focus on deep learning architectures designed for processing and understanding image data.	10	1-6	1-4	3	3	✔		✔
3	**Recurrent Neural Networks (RNNs) and LSTMs**: Study of models that handle sequential data, crucial for tasks like language modeling and time-series prediction.	6	1-4	5-6	4	1-4	✔		✔
4	**Deep Learning Model Optimization**: Techniques for improving model performance, including hyperparameter tuning, regularization, and optimization algorithms.	3	3-4	6-7	4-5	3-5	✔		✔
5	Case Study	3	6-7	1	6	4-5	✔		✔

Course Coordinator | Prof.Dr. Khaled Fathy   Department Head | Prof.Dr. Khaled Fathy

Signature   Signature

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Assiut University
Faculty of Computers & Information
Quality Assurance Unit

Course Specifications

Relevant program	Master in Computers and Information (Bioinformatics)
Department offers the program	Information Systems
Department offers the course	Information Systems
Academic year	1st Year
Date of specification approval	1/9/2021

A. Basic Information

4. **Course Title:** Big Data Management
5. **Course Code:** (IS600)
6. **Course hours per week:**

Lecture	Tutorial / Practical	Total
2	–	2

B. Professional Information

1. Overall aims of the course

Upon completing this course, the student will be able to:

- Understanding Big Data Concepts and Algorithms.
- Implementing Big Data Solutions.
- Analyzing and Managing Data at Scale.
- Handling Data Quality and Consistency.
- Exploring Advanced Topics in Big Data

2. Intended Learning Outcomes (ILOs) of the course

a. Knowledge and Understanding
On successful completion of the program, graduates should be able to:

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a1. Identify theories and fundamentals in bioinformatics, concepts of biology, computer science and mathematics and related domains.
a3. Discuss scientific development in bioinformatics.
a5. Identify quality principles of professional practice in information systems.

b. Intellectual Skills

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

b1. Analyze and evaluate the information in bioinformatics domain and its applications
b3. Link different knowledge to solve professional problems.
b4. Carry out a research study and write a thesis around a research problem in information systems.
b5. Assess risks in professional practice of Bioinformatics.
b6. Plan to develop the performance in Bioinformatics.
b8. Specify and design intelligent and traditional computer-based systems, using formal design procedures where appropriate.
b9. Extract information from large databases.

c. Professional and Practical Skills

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

c1. Master basic and modern professional skills.
c3. Evaluate the strengths and weaknesses of particular solutions in bioinformatics.
c5. Deal with bioinformatics ethical problems.

d. General and Transferable Skills

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

d2. Use the information technology to serve the professional practice.
d3. Have self-assessment and identification of personal learning needs.
d8. Long-life self-learning.
d9. Synthesize ideas from multiple sources.

3. Contents

No	Topic taught	No. of hours		ILOs
		Lecture	Tut/Prac	
1	understanding Big Data Concepts and Algorithms	7h	----	a3, c1, d4
2	Implementing Big Data Solutions	6h	-----	b1, b8, c1, d2
3	Analyzing and Managing Data at Scale	5h	----	b3, b6, c3
4	Handling Data Quality and Consistency	4h	----	a5, b5, c3
5	Exploring Advanced Topics in Big Data	4h		b4, d9

4. Teaching and Learning Methods

4a. Lectures
4b. Tutorial Exercises
4c. Projects

5. Student Assessment

5a. Tools

Final Exam	To measure knowledge, understanding, intellectual professional and general skills.
Projects	To measure professional and general skills

5b. Time Schedule

Assessment	Week No
Final Exam	13

5c. Grading System

Assessment	Grade %
Final Exam	70%
Year Work	30%

5d. Formative Assessment

Regular quizzes distributed along the whole semester.

6. List of References

6a. Course Notes
- Short course notes available at the course homepage.

6b. Required Books (Textbooks)
- Balamurugan Balusamy, Nandhini Abirami R., Seifedine Kadry, and Amir H. Gandomi, Big Data: Concepts, Technology, and Architecture, 2020, Wiley.

6c. Recommended Books
- Rajkumar Buyya, Rodrigo N. Calheiros, and Amir Vahid Dastjerdi, Big Data: Principles and Paradigms, 2016, Wiley.

6d. Web Sites
- Course homepage is accessed from the FCI website:
  http://www.aun.edu.eg/Courses/

7. Facilities Required for Teaching and Learning

- A lecture hall equipped with projectors and computers.
- Labs equipped with computers and Internet facilities.
- A library.
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Course Coordinator: Prof.Dr. Taysir H. Abdel-Hamid

Signature:

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Date: 1/9/2021

Department Head: Prof.Dr. Taysir H. Abdel-Hamid

Signature:

Date: 1/9/2021

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Course Matrix

Course Name   Big Data Management   Course Code: IS600

No	Course Content	Teaching Weeks	ILOs				Teaching and Learning Methods	Assessment Tools	Criteria
			a's	b's	c's	d's	Lectures	Final Exam & Year Work	
1	understanding Big Data Concepts and Algorithms	8	1,3	1,3	1-2	2-3	✓	✓	**Student evaluation, course file, exam results**
2	Implementing Big Data Solutions	10	1,3	4-6	3	2-3	✓	✓	
3	Analyzing and Managing Data at Scale	5	1,5	1,5	1,5	2,8	✓	✓	

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4	Handling Data Quality and Consistency	4	3,5	8-9	3,5	3,8	✔	✔
5	Exploring Advanced Topics in Big Data	2	1,5	3-6	3	2,9	✔	✔
6	Case Study	1	1,3,5	9	5	8-9	✔	✔

Course Coordinator | **Prof.Dr. Taysir H. Abdel-Hamid** | **Department Head** | **Prof.Dr. Taysir H. Abdel-Hamid**

Signature | **Signature**

Course Specifications

Relevant program	Master in Computers and Information(Bioinformatics)
Department offers the program	Bioinformatics
Department offers the course	Bioinformatics
Academic year	1st Year
Date of specification approval	1/9/2021

A. Basic Information

1. **Course Title:** Elective Course III (Systems Biology)
2. **Course Code:** BNF603
3. **Course hours per week:**

Lecture	Tutorial / Practical	Total
2	–	2

B. Professional Information

1. Overall aims of the course

Upon completing this course, the student will be able to:
- Understand the Principles of Systems Biology.
- Learn Modelling Techniques for Biological Processes.
- Explore Algorithms for Network Reconstruction.
- Apply Computational Methods to Biological Systems.
- Develop Skills in Biological Network Analysis.

2. Intended Learning Outcomes (ILOs) of the course

a. Knowledge and Understanding

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

a1. Identify theories and fundamentals in bioinformatics, concepts of biology, computer science and mathematics and related domains.

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a2. Define effective exchange between professional practices and their reflection on the environment.

a4. Explain ethical and legal principles for professional practice in information systems.

a6. Define the fundamentals of scientific research and its ethics.

a8. Identify the intersection of life and information sciences, the core of shared concepts, language and skills the ability to speak the language of structure-function relationships, information theory, gene expression, and database queries.

b. Intellectual Skills

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

b1. Analyze and evaluate the information in bioinformatics domain and its applications.

b3. Link different knowledge to solve professional problems.

b6. Plan to develop the performance in Bioinformatics.

b7. Take professional decisions in different scenarios.

c. Professional and Practical Skills

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

c1. Master basic and modern professional skills.

c2. Write and evaluate professional reports.

c4. Apply evidence and make evidence-based decisions.

d. General and Transferable Skills

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

d1. Communicate efficiently by different means.

d4. Use different recourses to obtain information and knowledge.

d8. Long-life self-learning.

d10.   Develop an argument in a coherent and logical manner.

3. Contents

N o	Topic taught	No. of hours		ILOs
		Lecture	Tut/Prac	
1	Understand the Principles of Systems Biology.	6h	----	a1, a2, b1, d4
2	Learn Modelling Techniques for Biological Processes.	5h	-----	a1, c1, d4, d1
3	Explore Algorithms for Network Reconstruction.	6h	----	b6, b7, c1, c2
4	Apply Computational Methods to Biological Systems.	5h	----	a8, b1, b7, c2
5	Develop Skills in Biological Network Analysis.	4h	----	a4, a6, d10, d8

4. Teaching and Learning Methods

4a. Lectures

4b. Tutorial Exercises

4c. Projects

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5. Student Assessment

5a. Tools

Final Exam	To measure knowledge, understanding, intellectual professional and general skills.
Projects	To measure professional and general skills

5b. Time Schedule

Assessment	Week No
Final Exam	13

5c. Grading System

Assessment	Grade %
Final Exam	70%
Year Work	30%

5d. Formative Assessment

Regular quizzes distributed along the whole semester.

6. List of References

6a. Course Notes
- o Short course notes available at the course homepage.

6b. Required Books (Textbooks)
- o "Constraint-Based Modeling and Analysis in Systems Biology" by Bernhard O. Palsson.

6c. Recommended Books
- o "Biochemical Systems Analysis: A Study of Function and Design in Molecular Biology" by Michael Savageau.

6d. Web Sites
- o Course homepage is accessed from the FCI website: http://www.aun.edu.eg/Courses/

7. Facilities Required for Teaching and Learning

- A lecture hall equipped with projectors and computers.
- Labs equipped with computers and Internet facilities.
- A library.

Course Coordinator: Dr. Ibrahim ElSamman

Signature:

Date: 1/9/2021

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Department Head: Prof. Dr. Taysir H. Abdel-Hamid

Signature:

Date: 1/9/2021

Assiut University
Faculty of Computers & Information
Quality Assurance Unit

Course Matrix

Course Name   Elective Course III (Systems Biology)   Course Code: BNF603

No	Course Content	Teaching Weeks	ILOs				Teaching and Learning Methods	Assessment Tools	Criteria
			a's	b's	c's	d's	Lectures	Final Exam & Year Work	
1	Understand the Principles of Systems Biology.	3	1-2	1,3	1-2	1,4	✔	✔	
2	Learn Modelling Techniques for Biological Processes.	5	1,4	3,6	2,4	8	✔	✔	**Student evaluation, course file, exam results**
3	Explore Algorithms for Network Reconstruction.	4	1,4	1,7	4	4	✔	✔	

4	Apply Computational Methods to Biological Systems.	2	2,4	6-7	1	8,10	✓	✓
5	Develop Skills in Biological Network Analysis.	3	6,8	1,3	2,4	1,10	✓	✓
6	Case Study	1	1,8	3,7	1,4	4,8	✓	✓

Course Coordinator	Dr. Ibrahim ElSamman	Department Head	Prof. Dr. Taysir H. Abdel-Hamid
Signature		Signature	

Assiut University
Faculty of Computers & Information
Quality Assurance Unit

Course Specifications

Relevant program	Master in Computers and Information(Bioinformatics)
Department offers the program	Bioinformatics
Department offers the course	Bioinformatics
Academic year	1st Year
Date of specification approval	1/9/2021

C. Basic Information

4. **Course Title:** Elective Course IV (Advanced Topics in Computational Biology)
5. **Course Code:** BNF600
6. **Course hours per week:**

Lecture	Tutorial / Practical	Total
2	–	2

D. Professional Information

1. Overall aims of the course

Upon completing this course, the student will be able to:
- Master High Throughput Sequence Data Analysis.
- Understand Genome Structure and Evolution.
- Apply Computational Techniques for Genome Sequence Analysis.
- Identify and Characterize Non-Coding RNA.
- Explore RNA Interaction Prediction and Analysis.

2. Intended Learning Outcomes (ILOs) of the course

a. Knowledge and Understanding

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

a2. Define effective exchange between professional practices and their reflection on the environment.

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a4. Explain ethical and legal principles for professional practice in information systems.

a5. Identify quality principles of professional practice in information systems.

a6. Apply the fundamentals of scientific research and its ethics.

a8. Identify the intersection of life and information sciences, the core of shared concepts, language and skills the ability to speak the language of structure-function relationships, information theory, gene expression, and database queries.

b. **Intellectual Skills**

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

b2. Solve specialized problems without enough inputs, including the ability to develop new algorithms and analysis methods.

b3. Link different knowledge to solve professional problems.

b5. Assess risks in professional practice of Bioinformatics.

b6. Plan to develop the performance in Bioinformatics.

b7. Take professional decisions in different scenarios.

b8. Specify and design intelligent and traditional computer-based systems, using formal design procedures where appropriate.

b9. Extract information from large databases.

c. **Professional and Practical Skills**

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

c2. Write and evaluate professional reports.

c3. Evaluate the strengths and weaknesses of particular solutions in Bioinformatics.

c2. Deal with bioinformatics ethical problems.

d. **General and Transferable Skills**

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

d1. Communicate efficiently by different means.

d2. Use information technology to serve the professional practice.

d4. Use different recourses to obtain information and knowledge.

d6. Work in a team and lead teams in different professional tracks.

d8. Long-life self-learning.

d9. Synthesize ideas from multiple sources.

3. Contents

N o	Topic taught	No. of hours		ILOs
		Lecture	Tut/Prac	
1	Understanding Social Network Structures.	6h	----	a2, a6, a8, b3, b5, d4
2	Applying Analytical Techniques to Social Networks.	6h	-----	b2, b6, b9, c3, d2
3	Extracting Insights from Social Media Data.	5h	----	a5, b3, c2, c5, d4, d9
4	Evaluating the Impact of Social Networks.	5h	----	a2, a5, b5, b7, d1, d4

5	Addressing Ethical and Privacy Issues in Social Network Analysis	4h	----	a4, a6, d6, d9

4. Teaching and Learning Methods

4a. Lectures

4b. Tutorial Exercises

4c. Projects

5. Student Assessment

5a. Tools

Final Exam	To measure knowledge, understanding, intellectual professional and general skills.
Projects	To measure professional and general skills

5b. Time Schedule

Assessment	Week No
Final Exam	13

5c. Grading System

Assessment	Grade %
Final Exam	70%
Year Work	30%

5d. Formative Assessment

Regular quizzes distributed along the whole semester.

6. List of References

6a. Course Notes

o   Short course notes available at the course homepage.

6b. Required Books (Textbooks)

o   "Computational Biology: A Practical Introduction to BioData Processing and Analysis with Linux, MySQL, and R" by Röbbe Wünschiers.

6c. Recommended Books

o   "Biological Data Mining and Its Applications in Healthcare" by Xiaoli Li and See-Kiong Ng.

6d. Web Sites

o   Course homepage is accessed from the FCI website: http://www.aun.edu.eg/Courses/

7. Facilities Required for Teaching and Learning

● A lecture hall equipped with projectors and computers.

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- Labs equipped with computers and Internet facilities.
- A library.

Course Coordinator: Dr. Ibrahim ElSamman

Signature:

Date: 10/2/2022

Department Head: Prof. Dr. Taysir H. Abdel-Hamid

Signature:

Date: 10/2/2022

Course Matrix

Course Name	Elective Course IV (Advanced Topics in Computational Biology)						Course Code: BNF600	

No	Course Content	Teaching Weeks	ILOs				Teaching and Learning Methods	Assessment Tools	Criteria
			a's	b's	c's	d's	Lectures	Final Exam & Year Work	
1	Understanding Social Network Structures.	2	2, 4	2-3	2, 3	1,4	✔	✔	**Student evaluation, course file, exam results**
2	Applying Analytical Techniques to Social Networks.	5	4-6	5-7	3, 5	2,6	✔	✔	
3	Extracting Insights from Social Media Data.	4	8	6-8	2, 5	4,8	✔	✔	
4	Evaluating the Impact of Social Networks.	6	4, 8	8-9	5	8,9	✔	✔	

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5	Addressing Ethical and Privacy Issues in Social Network Analysis	4	6, 8	2,8	2	1,2	✓	✓	
6	Case Study	1	1, 5	3,6	3	4,6	✓	✓	

Course Coordinator	**Dr. Ibrahim ElSamman**	**Department Head**	**Prof. Dr. Taysir H. Abdel-Hamid**
Signature		**Signature**	

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Seminar Specifications

Seminar Specifications

Relevant program	Master in Computers and Information (Bioinformatics)
Department offers the program	Bioinformatics
Department offers the course	Bioinformatics
Academic year	1st Year
Date of specification approval	1/9/2021

A. Basic Information

1. **Title:** Seminar

B. Professional Information

1. Overall aims of the thesis

Upon completing this thesis, the student will have learned, through appropriate discussion and laboratory experiences, the following.

- Read ana analyze research papers in some trending topics.

- Summarize important information in research papers.

- Search and find the most appropriate research papers.

- Integrate information and conduct state of the art review and survey paper.

2. Intended Learning Outcomes (ILOs) of the course

a. Knowledge and Understanding

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

a1. Identify theories and fundamentals in bioinformatics, concepts of biology, computer science and mathematics and related domains.

a2. Define effective exchange between professional practices and their reflection on the environment.

a3. Discuss scientific development in bioinformatics.

a5. Identify quality principles of professional practice in information systems.

a6. Define the fundamentals of scientific research and its ethics.

a7. Identify role of bioinformatics in organizations.

a8. Identify the intersection of life and information sciences, the core of shared concepts, language and skills the ability to speak the language of structure-function relationships, information theory, gene expression, and database queries.

`

b. Intellectual Skills

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

b1. Analyze and evaluate the information in bioinformatics domain and its applications

b3. Link different knowledge to solve professional problems.

b4. Carry out a research study and write a thesis around a research problem in information systems.

b5. Assess risks in professional practice of Bioinformatics.

b6. Plan to develop the performance in Bioinformatics.

b8. Specify and design intelligent and traditional computer-based systems, using formal design procedures where appropriate.

c. Professional and Practical Skills

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

c1. Master basic and modern professional skills.

c2. Write and evaluate professional reports.

c3. Evaluate the strengths and weaknesses of particular solutions in bioinformatics.

d. General and Transferable Skills

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

d2. Have self-assessment and identification of personal learning needs.

d3. Use different recourses to obtain information and knowledge.

d4. Propose roles and indicators to evaluate the performance of the others.

d5. Work in a team and lead teams in different professional tracks.

d6. Manage time efficiently.

d7. Long-life self-learning.

d8. Synthesize ideas from multiple sources.

d9. Develop an argument in a coherent and logical manner

3. Teaching and Learning Methods

1. Discussion
2. Workshops
3. Projects
4. Case Study
5. Data Collections

4. Student Assessment

5a. Tools

Oral examination	Knowledge and Understanding - Intellectual Skills - General Skills

5. Facilities Required for Teaching and Learning

- Labs equipped with computers and Internet facilities.

- Discussion rooms.

- Digital library contains links to international journals.

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- A library.

Department Head: Dr. Taysir H. Abdel-Hamid

Signature:

Date: 1/9/2021

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Thesis Specifications

Bioinformatics Master Thesis Specifications

Relevant program	Master in Computers and Information (Bioinformatics)
Department offers the program	Bioinformatics
Department offers the course	Bioinformatics
Academic year	2nd Year
Date of specification approval	1/9/2021

A. Basic Information

2. **Title:** Master Thesis

B. Professional Information

1. Overall aims of the thesis

Upon completing this thesis, the student will have learned, through appropriate discussion and laboratory experiences, the following.

- Doing the research.
- Contributing something original to the field.
- Ethical issues for the research by the University Ethics Committee.
- The topic matches the student' interests and capabilities.

2. Intended Learning Outcomes (ILOs) of the course

a. Knowledge and Understanding

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

a1. Describe effective exchange between professional practices and their reflection on the environment.
a2. Discuss scientific development in information systems.
a3. Explain ethical and legal principles for professional practice in information systems.
a4. Discuss quality principles of professional practice in information systems.
a5. Discuss the fundamentals of scientific research and its ethics.

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b. Intellectual Skills

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

b1. Analyze and evaluate the information in the domain of information systems and take references from them for problem solving.

b2. Solve specialized problems without enough input.

b3. Link different knowledge to solve professional problems.

b4. Carry out a research study and write a thesis around a research problem in information systems.

b5. Assess risks in professional practice of information systems.

b6. Plan to develop the performance in information systems.

b7. Take professional decisions in different scenarios.

c. Professional and Practical Skills

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

c1. Master basic and modern professional skills in information systems.

c2. Write and evaluate professional reports.

c3. Evaluate current methods and tools in information systems.

d. General and Transferable Skills

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

d2. Use information technology to serve professional practice.

d3. Have self-assessment and identification of personal learning needs.

d4. Use different recourses to obtain information and knowledge.

d5. Propose roles and indicators to evaluate the performance of the others.

d6. Work in a team and lead teams in different professional tracks.

d7. Manage time efficiently.

d8. Long-life self-learning.

d9. Synthesize ideas from multiple sources.

d9. Develop an argument in a coherent and logical manner

3. Teaching and Learning Methods

1. Discussion
2. Workshops
3. Projects
4. Case Study
5. Data Collections

4. Student Assessment

4a. Tools

Oral examination	Knowledge and Understanding - Intellectual Skills - General Skills
Thesis	Knowledge and Understanding - Intellectual Skills - Professional Skills - General Skills

5. Facilities Required for Teaching and Learning

- Labs equipped with computers and Internet facilities.
- Advanced research labs.

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- Discussion rooms.
- Digital library contains links to international journals.
- A library.

Department Head: Dr. Taysir H. Abdel-Hamid

Signature:

Date: 1/9/2021