



Program SPECIFICATION FOR *Master Degree* in Biomedical Image Processing

Code: 1720700

University: Alexandria

Faculty: Medical Research Institute

Program Specification

A. Basic information

1- Program title : Master degree in Biomedical Image Processing

2- Program type: single double multiple

3- Department(s) : *Biomedical Engineering*

4- Coordinator : Pro.Dr. Saleh El Shaby

5- External evaluator(s): Prof.Dr/ Amin shokry

6- Last date of program specification approval: 8/1/2017

A- Professional Information

1- Program aims:

The aim of this program is to provide advanced interdisciplinary training in biomedical engineering skills that play a crucial role in biomedical research. The department has identified biological and medical imaging as a skill area of national unmet need where capacity must be increased to support biomedical research.

The curriculum covers both biological and medical imaging aspects to prepare the student to process and analyze the resulting image data and to program solutions to specific digital image tasks for a career in industrial or academic research and development.

At completion of this programme the student will be able to



1. *Demonstrate a comprehensive understanding of physical principles associated with biomedical engineering.*
2. *Recognize how to detect shape /function changes in image data that are characteristic of disease.*
3. *Identify the working principles behind the maintenance and management of biomedical instruments and safety procedures in a wide range of medical physics and biomedical engineering applications.*
4. *Acquire a high level of practical, analytical, communication and research skills.*
5. *Address the question of how to develop computer models of disease that can be used to understand disease mechanisms.*
6. *Examine information systems used in clinical practice*

2- Intended learning outcomes (ILOS)

a- knowledge and understanding:

- A1- Review the functions of several physiological systems with human body.
- A2- Order the research method in details.
- A3- Review modelling strategies in physiology
- A4- **Recall** beneficence and nonmaleficence medical ethics
- A5- Explain the fundamental components contained in a typical general purpose image processing system.
- A6- **Discuss** the essential facts, concepts, principals and theories of electrophysiological function.

b- Intellectual skills:

- B1- Distinguish between the different activities for biomedical engineers.
- B2- Compare between sensors and electrodes.
- B3- Analyze biomedical signals.



- B4- Examine the indications of using various imaging techniques.
- B5- Examine different methodologies of problem solving through utilization of wide range of medium level image processing techniques.
- B6- Criticize a structured Introduction section in a scientific paper or research.
- B7- Compare between different distributed computer systems.
- B8- Examine problem solving as regards types of research design.

c- professional and practical skills:

- C1- Demonstrate dialysis machines used in hemodialysis.
- C2. Demonstrate buffer preparation, acid base balance and muscle demonstration
- C3- Apply voltometric sensors.
- C4- Apply signals using a variety of engineering tools like MATLAB.
- C5- Demonstrate the principle of operation of X-ray machine .
- C6- Practice on different algorithms that can be used to process digital images using MATLAB software program.
- C7- Practice on Matlab Simulink software to simulate physiological models.
- C8- Use Scoop for organizing information.
- C9- Practice in Medical Research Institute Intensive Care Unit using safety analyzer
- C10- Apply the appropriate analysis measure in different research techniques
- C11- Demonstrate network security
- C12- Use Prolog programming language to solve logic and decision problems.

d- General and transferable skills:

- D1- Develop skills in communication.
- D2- Manage time.
- D3- Develop skills in communication.



D4- Gives oral presentations.

D5- Use conventional and electronic resources to collect, select and organize complex scientific information.

D6- Perform critical appraisal of information and published material.

D7- Use information technology to improve his professional practice.

D8- Use different sources of information to obtain data.

D9-Develop skills in Reading & Researches

D10- Develop skills in systematic thinking

3- Academic standards

3a External references for standards (Benchmarks)

Generic Academic Reference Standards of the National Authority for Quality Assurance and Accreditation of Education (NAQAAE)

**Date of Academic Reference standards (ARS) approval by Institute Council:
12/2/2014**

3b Comparison of provision to selected external references

Generic Academic Standards	ARS of master degree in Biomedical Image Processing
<p>➤ <i>A1-Basic facts , theories, of the specialty and related subjects/ fields</i></p>	<p><i>A1. Describe the functions of several physiological systems in human body.</i></p> <p><i>A2. Recognize different biomedical signals induced from human body.</i></p>
<p>➤ <i>A2-Mutual relation between professional practice and effects on environment</i></p>	<p><i>A3. Explain the function of the main steps for analyzing digital medical images for enhancing patient diagnosis.</i></p>



➤ <i>A3-Main scientific advances in the field of practice</i>	<i>A4- Recognize the main advances in the field of biomedical image processing</i>
➤ <i>A4-Fundamentals of ethical & legal practice</i>	<i>A5-Recognize the ethical regulations associated with the use of medical devices.</i>
➤ <i>A5-Quality standards of the practice</i>	<i>A6- Recognize the quality standards of the practice in the field of biomedical image processing.</i>
➤ <i>A6-Basics and ethics of scientific research</i>	<i>A7-Order the research method in details. A8-Identify intellectual property rights.</i>
➤ <i>B1-Interpret, analyze & evaluate the information to solve problems</i>	<i>B1- Analyze biosignals using signal processing techniques.</i>
➤ <i>B2-Solve some problems that do not conform to classic data (incomplete data)</i>	<i>B2- Examine dynamic physiological systems using simulation modeling techniques.</i>
➤ <i>B3-Integrate different information to solve professional problems</i>	<i>B3- Compare different information to solve professional problems through thesis</i>
➤ <i>B4-Conduct a scientific research &/Or write scientific systematic approach to a research problem (hypothesis)</i>	<i>B4- Examine scientific papers through thesis</i>
➤ <i>B5-Evaluate risks imposed during professional practice.</i>	<i>B5- Examine effect of using non efficient image processing techniques for analyzing medical images on patient diagnosis during preparation of thesis.</i>



➤ <i>B6-Plan for professional improvement</i>	<i>B6- Analyze student questionnaire for professional improvement plan</i>
➤ <i>B7-Take professional decisions in wide range of professional situations</i>	<i>B7.Comparing different biosensors for capturing bioelectrical signals.</i>
➤ <i>C1-Competent in all basic and some of the advanced professional skills (to be determined according to the specialty board/ department)</i>	<i>C5. Sketch various medical devices used in operation room or in hospitals.</i> <i>C7.Demonstrate different aspects in bioelectric phenomena.</i>
➤ <i>C2-Write and appraise reports</i>	<i>C3. Practice on writing a research protocol.</i>
➤ <i>C3-Evaluate methods and tools used in specialty</i>	<i>C1. Apply different image processing techniques on digital images using MATLAB.</i> <i>C2.Apply physiological models on MATLAB simulink software.</i> <i>C4- Apply various medium and high levels image processing techniques for extracting object features.</i> <i>C6.Practice on using different technical computer programs used in hospital information system construction.</i>
➤ <i>D1-Communicate effectively using all methods</i>	<i>D1- Develop skills in communication</i>
➤ <i>D2-Use information technology to improve his/her professional practice</i>	<i>D2- Use information technology to improve professional practice and use different sources of information to obtain data</i>
➤ <i>D3-Practice self appraisal and determines his learning needs</i>	<i>D3- Develop skills in self appraisal and seek continuous learning during preparation</i>



	<i>of thesis.</i>
➤ <i>D4-Share in determination of standards for evaluation of others (e.g.: subordinates/ trainees etc.)</i>	<i>D4.Develop skills of evaluating different scientific papers based on scientific regulations.</i>
➤ <i>D5-Use different sources of information to obtain data</i>	<i>D5.Use of World Wide Web, digital libraries to obtain required data for research.</i>
➤ <i>D6-Work in teams</i>	<i>D6. Develop a culture of disseminating and sharing information with peers.</i>
➤ <i>D7-Manage time effectively</i>	<i>D7. Develop skill in time Management through giving oral presentation and sending required activities before deadline.</i>
➤ <i>D8-Work as team leader in situations comparable to his work level</i>	<i>D8- Election of students for representation in department's council.</i>
➤ <i>D9-Learn independently and seek continuous learning</i>	<i>D9- Use of resources (www, research articles,) other than lecture notes to master his research point during preparation of thesis.</i>

4- curriculum structure and contents

4.a program duration:3-5 years

4.b program structure :

4.b.i- No. of hours per week in each year/semester:

Semester	Core Courses	Elective Courses
	No. of hours	No. of hours



First semester	10 hrs	3 hrs
Second semester	3 hrs	6 hrs
Third semester	8 hrs	-

4.b.ii- No. of credit hours Lectures Practical Total

Compulsory Elective Optional

4.b.iii- No. of credit hours of basic science courses No. %

4.b.iv- No. of credit hours of courses of social sciences and humanities. No. %

4.b.v- No. of credit hours of specialized courses No. %

4.b.vi- No. of credit hours of other courses No. %

4.b.vii-Practical/Field Training Yes No

4.b.viii- Program levels (in credit-hours system)

Student is required to pass at least 12 credit hours with CGPA not less than C+ before submitting a thesis proposal.

5- Program Courses

5.1- Compulsory (21 hours)

Code No.	Course Title	No. of credit hours	No. of hours /week	
			Lecture	Practical
1720701	Introductionto Biomedical Engineering	4	3	2
1720704	Biomedical signal Analysis	3	2	2
1720705	DiagnosticImaging	3	2	2
1720711	Medical Informatics	3	2	2
1720712	Technical Report Writing and presentationskills	2	2	0



1720715	introduction to Digital image Processing	3	2	2
1720716	Advanced Topics in Digital image Processing	3	2	2

5.2- Elective I (9 hours)

Code No.	Course Title	No. of credit hours	No. of hours /week	
			Lecture	Practical
1720702	Bioelectric Phenomena	3	2	2
1720703	Biomedical Sensors	3	2	2
1720708	Physiological Modeling simulation and control	3	2	2
1720713	Ethical issues associated with the use of Medical Technology	3	2	2
1720714	Design of Experiment	3	2	2
1720717	Security Systems	3	2	2
1720718	Artificial Intelligence and Machine Learning	3	2	2

5.3- Elective II (none)**5.4- Optional – (none)****6- Program admission requirements**

Graduate Students with a B.Sc. of engineering or its equivalent.

7- Regulations for progression and program completion

For the progression and completion of the program to obtain the degree of Master in Biomedical Image Processing, the student must:

- 1- Complete 30 credit hours with CGPA of at least C+.
- 2- Submit a thesis validity report by an examination committee approved by the department council and their members include at least two external examiners.

8- Evaluation of Students enrolled in the program. -3

Tool evaluation	Intended learning outcomes being assessed
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Written	ILOs a & b
Practical	ILOs c
Oral	ILOs a ,b & d
Semester Work	ILOs b & d

Evaluation of the Program

Evaluator	Tool	Sample
1- Senior students	Interview	50 %
2- Alumni	Interview	Representative sample
3- Stakeholders (Employers)	Interview	Representative sample
4- External Evaluator(S) or External Examiner (s)	Reports	Name of evaluator): Prof.Dr/ Amin shokry
5- Other		

Dates of Previous editions/revisions:

Editions/Revisions Number	Date
Edition no.1	2009
Edition no. 2	2011
Edition no.3	5/6/2014
Edition no.3, revision no.1	12/2014
Edition no.3, revision no.2	10/2016
Edition no.3, revision no.3	9/2017

Program coordinator :

Name: Prof.Dr. Saleh El Shehaby

Signature:



Department Head:

Name: Prof. Dr. Saleh El Shehaby

Signature:

Date of Department Council Approval: 6/9/2017

****Program Aims vs ILOs matrix***

PROGRAMME ILOs AIMS	A1	A2	A3	A4	A5	A6	B1	B2	B3	B4	B5	B6	B7	B8
1. Demonstrate a comprehensive understanding of physical principles associated with biomedical engineering.	X			X	X	X	X							
2. Recognize How to detect shape /function changes in image data that are characteristic of disease.								X	X		X		X	
3. Identify the working principles behind the maintenance and management of								X		X				



biomedical instruments and safety procedures in a wide range of biomedical engineering applications.														
4. Acquire a high level of practical, analytical, communication and research skills.		X							X			X		X
5. Address the question of how to develop computer models of disease that can be used to understand disease mechanisms.			X											
6. Examine information systems used in clinical practice.													X	

PROGRAMME ILOS AIMS	C1	C2	C3	C4	C5	C6	C7	C8	C9	C10	C11	C12
1. Demonstrate a comprehensive understanding of physical principles associated with biomedical engineering.												
2. Recognize How to detect shape /function changes				X		X	X					



in image data that are characteristic of disease												
3. Identify the working principles behind the maintenance and management of biomedical instruments and safety procedures in a wide range of biomedical engineering applications.	X	X	X	X	X	X						
4. Acquire a high level of practical, analytical, communication and research skills.	X	X	X	X	X	X	X	X	X	X	X	X
5. Address the question of how to develop computer models of disease that can be used to understand disease mechanisms.							X					
6. Examine information systems used in clinical practice.								X			X	X



PROGRAMME ILOS AIMS	D1	D2	D3	D4	D5	D6	D7	D8	D9	D10	D11
1. Demonstrate a comprehensive understanding of physical principles associated with biomedical engineering.											
2. Recognize How to detect shape /function changes in image data that are characteristic of disease											
3. Identify the working principles behind the maintenance and management of biomedical instruments and safety procedures in a wide range of biomedical engineering applications.											
4. Acquire a high level of practical, analytical, communication and research skills.	X	X	X	X	X	X	X	X	X	X	X
5. Address the question of how to develop computer models of disease that can be used to understand disease											



mechanisms.											
6. Examine information systems used in clinical practice.											

*** Courses vs Program ILOs matrix**

Course Title	Code ID	A1	A2	A3	A4	A5	A6	B1	B2	B3	B4	B5	B6	B7	B8
Introduction to Biomedical Engineering	1720701	X						X							
Bioelectric Phenomena	1720702						X								
Biomedical sensors	1720703								X						
Biomedical Signal Analysis	1720704									X					
Diagnostic Imaging	1720705										X				
Physiological Modeling, simulation and control	1720708			X											
Medical Informatics	1720711													X	
Technical Report Writing and presentation skills	1720712		X								X		X		
Ethical Issues Associated with the use of medical technology	1720713				X										
Design of Experiments	1720714														X



Course Title	Code ID	A1	A2	A3	A4	A5	A6	B1	B2	B3	B4	B5	B6	B7	B8
Introduction to Digital image processing	1720715					X									
Advanced Topics in Digital Image processing	1720716											X			
Security Systems	1720717													X	
Artificial Intelligence and Machine Learning	1720718													X	

Course Title	Code ID	C1	C2	C3	C4	C5	C6	C7	C8	C9	C10	C11	C12
Introduction to Biomedical Engineering	1720701	X											
Bioelectric Phenomena	1720702		X										
Biomedical sensors	1720703			X									
Biomedical Signal	1720704				X								



Course Title	Code ID	C1	C2	C3	C4	C5	C6	C7	C8	C9	C10	C11	C12
Analysis													
Diagnostic Imaging	1720705					X							
Physiological Modeling, simulation and control	1720708							X					
Medical Informatics	1720711								X				
Technical Report Writing and presentation skills	1720712												
Ethical Issues Associated with the use of medical technology	1720613									X			
Design of Experiments	1720614										X		
Introduction to Digital image processing	1720615						X						
Advanced Topics in Digital Image processing	1720616						X						
Security Systems	1720617											X	



Course Title	Code ID	C1	C2	C3	C4	C5	C6	C7	C8	C9	C10	C11	C12
Artificial Intelligence and Machine Learning	1720618												X

Course Title	Code ID	D1	D2	D3	D4	D5	D6	D7	D8	D9	D10
Introduction to Biomedical Engineering	1720701	X	X	X							
Bioelectric Phenomena	1720702				X	X					
Biomedical sensors	1720703			X							
Biomedical Signal Analysis	1720704	X	X	X			X	X			
Diagnostic Imaging	1720705		X	X							
Physiological Modeling, simulation and control	1720708									X	
Medical Informatics	1720711		X								
Technical Report Writing and presentation skills	1720712								X		
Ethical Issues Associated with	1720613			X					X		



Course Title	Code ID	D1	D2	D3	D4	D5	D6	D7	D8	D9	D10
the use of medical technology											
Design of Experiments	1720614										X
Introduction to Digital image processing	1720615	X	X	X							
Advanced Topics in Digital Image processing	1720616	X	X	X							
Security Systems	1720617	X									
Artificial Intelligence and Machine Learning	1720618	X									



Program ILOs versus ARS FOR *Master Degree in Biomedical Image Processing*

PROGRAMME ILOS ARS	A1	A2	A3	A4	A5	A6
A1. Define various tissue and pathological terminology.	X					
A2. Restate the major objectives of signal analysis.			X			X
A3. Explain the function of the main steps for analyzing digital medical images for enhancing patient diagnosis.					X	
A4- Recognize the main advances in the field of biomedical image processing					X	
A5-Recognize the ethical regulations associated with the use of medical devices.				X		



<i>A6- Recognize the quality standards of the practice in the field of biomedical image processing.</i>					X	
<i>A7-List the reasons to reject a paper for publication.</i>		X				
<i>A8-Identify intellectual property rights.</i>				X		

PROGRAMME	B 1	B 2	B 3	B 4	B 5	B 6	B 7	B 8
ARS								
<i>B1- Analyze problems facing digital images using different digital image processing techniques.</i>					X			
<i>B2- Examine dynamic physiological systems using simulation modeling techniques.</i>		X	X					
<i>B3-Analyze different information to solve professional problems through thesis</i>							X	X
<i>B4-Publish scientific papers through thesis</i>						X		X



<i>B5- Examine effect of using non efficient image processing techniques for analyzing medical images on patient diagnosis during preparation of thesis.</i>				X								
<i>B6- Analysis of student questionnaire for professional improvement plan</i>	X											
<i>B7.Examine the effect of using different intensity transformation functions on appearance of digital images.</i>							X					

PROGRAMME	C 1	C 2	C 3	C 4	C 5	C 6	C 7	C 8	C 9	C 10	C 11	C 12
ILOS												
ARS												
<i>C1. Apply different signal processing techniques using MATLAB.</i>				X								
<i>C2.Design physiological models on MATLAB simulink software.</i>							X					



<i>C3. Practice on writing a research protocol.</i>										X		
<i>C4- Apply various medium and high levels image processing techniques for extracting object features.</i>						X						
<i>C5. Sketch various medical devices used in operation room or in hospitals.</i>	X		X		X				X			
<i>C6. Practice on using different technical computer programs used in hospital information system construction.</i>								X			X	X
<i>C7. Demonstrate different aspects in bioelectric phenomena.</i>		X										



PROGRAMME	ILOS	D1	D2	D3	D4	D5	D6	D7	D8	D9	D	D11
	ARS										10	
	<i>D1- Develop skills in communication</i>		X									
	<i>D2- Use information technology to improve professional practice and use different sources of information to obtain data</i>			X								
	<i>D3- Develop skills in self appraisal and seek continuous learning during preparation of thesis.</i>				X							
	<i>D4. Develop skills of evaluating different scientific papers based on scientific regulations.</i>					X						
	<i>D5. Use of World Wide Web, digital libraries to obtain required data for research.</i>						X					
	<i>D6. Develop a culture of disseminating and sharing information with peers.</i>			X								
	<i>D7. Develop skill in time Management through giving</i>	X		X							X	



<i>oral presentation and sending required activities before deadline.</i>											
<i>D8- Election of students for representation in department's council.</i>		X									
<i>D9- Use of resources (www, research articles,) other than lecture notes to master his research point during preparation of thesis.</i>				X	X	X	X	X	X		

**Teaching and Learning Methods Vs Courses Matrix**

	1720701	1720704	1720705	1720711	1720712	1720715	1720716
Lecture	√	√	√	√	√	√	√
Practical/Clinical	√	√	√	√		√	√
Brainstorming			√		√		
Discussion Groups			√		√		
Problem Solving						√	
Case Study							
Field Training							
Role playing							
Training Workshops			√		√		
Self-Directed Learning			√	√	√		√
e-learning							
Project		√			√		



	1720702	1720703	1720708	1720713	1720714	1720717	1720718
Lecture	√	√	√	√	√	√	√
Practical/Clinical	√	√	√	√	√	√	√
Brainstorming					√		
Discussion Groups				√	√		√
Problem Solving	√		√		√		
Case Study			√				
Field Training							
Role playing							
Training Workshops							
Self-Directed Learning	√	√		√	√	√	√
e-learning							
Project		√	√				