Program SPECIFICATION FOR *Master* Degree in *Biomedical Devices*

Code: 1720700

University: Alexandria   **Faculty:** Medical Research Institute

Program Specification

A. Basic information

1- Programtitle :*Master degree in Biomedical Devices*

2- Program type: **single** | √ | **double** | | **multiple** | |

3- Department(s) :*Biomedical Engineering*

4- Coordinator :*Dr. Ahmad Nashaat*

5- External evaluator(s): *Prof.Dr/ Nour El Din Ismail*

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 engineering as a skill area of national unmet need where capacity must be increased to support biomedical research.

   The curriculum covers both biological and medical engineering aspects to prepare the student for a career in industrial or academic research and development.

At completion of this program the student will be able to

   1. *Demonstrate a comprehensive understanding of physical principles associated with biomedical engineering.*

   2. *Acquire a systematic understanding of physiological/biomedical measurements and statistics.*

3. Recognize *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- Discuss modelling strategies in physiology.

a4- Recall beneficence and non maleficence medical ethics.

a5-Describe & explain principles and application of neuro physiological assessments.

a6-Discuss the essential facts, concepts, principals and theories of elecrophysiological function.

a7- Describe operating systems, software security, risk assessment

a8- List the different techniques used for machine learning.

b- Intellectual skills:

b1- Distinguish between the different activities for biomedical engineers.

b2- Differentiate between sensors and electrodes.

b3- Analyze biomedical signals.

b4- Analyze the indications of using various imaging techniques.

b5-Examine the parameters that usually read from patient monitors.

b6-Criticize a structured Introduction section in a scientific paper or research.

b7-Calculate parameters in intensive monitoring.

b8-Examine problem solving as regards types of research design

b9- Compare between viruses

b10- Distinguish between blind and directed searches.

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 diathermy machine.

c7 - Illustrate the role of the main components of the hemodialyzer.

c8-Apply models on Matlab Simulink software.

c9- Practice brainstem, cranial nerve and reflex examination.

c10- use operating instruments in the ICU.

c11- Use Scoop for organizing information.

c12- Practice in Medical Research Institute Intensive Care Unit using safety analyzer

c13-Apply the appropriate analysis measure in different research techniques

c14-Employ network security

c15- Use Prolog programming language to solve logic and decision problems.

d- General and transferable skills:

d1- Manage time.

d2- Develop skills in communication.

d3- Gives oral presentations.

d4-Use conventional and electronic resources to collect, select and organize complex scientific information.

d5-Perform critical appraisal of information and published material.

d6- Use information technology to improve his professional practice.

d7- Use different sources of information to obtain data.

d8-Develop skills in Reading & Researches.

d9- Develop skills in systematic thinking.

d10-Use conventional and electronic resources to collect scientific information.

d11-Learn skills for planning and organization.

3- Academic standards

3a External references for standards (Benchmarks)

Generic Academic Reference Standards if 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 devices
➢ *A1-Basic facts , theories, of the specialty and related subjects/ fields*	*A1. Describe the functions of several physiological systems in human body.* *A2. Recognize different biomedical signals induced from human body.*
➢ *A2-Mutual relation between professional practice and effects on environment*	*A3. Translate different signal processing techniques on biosignals for enhancing patient diagnosis.*

➢ *A3-Main scientific advances in the field of practice*	*A4- Recognize the main advance in the field of biomedical engineering*
➢ *A4-Fundamentals of ethical & legal practice*	*A5-Recognize the ethical regulations associated with the use of medical devices.*
➢ *A5-Quality standards of the practice*	*A6-Recognize the quality standards of the practice in the field of biomedical engineering.*
➢ *A6-Basics and ethics of scientific research*	*A7-Order the research method in details.* *A8-Identify intellectual property rights.*
➢ ***B1-Interpret, analyze & evaluate the information to solve problems***	*B1- Analyze biosignals using signal processing techniques.*
➢ *B2-Solve some problems that do not conform to classic data (incomplete data)*	*B2- Examine dynamic physiological systems using simulation modeling techniques.*
➢ *B3-Integrate different information to solve professional problems*	*B3-Compare different information to solve professional problems through thesis*
➢ *B4-Conduct a scientific research &/Or write scientific systematic approach to a research problem (hypothesis)*	*B4- Examine scientific papers through thesis*
➢ *B5-Evaluate risks imposed during professional practice.*	*B5- Examine safety instructions associated with the use of medical devices.*
➢ *B6-Plan for professional improvement*	*B6- Analysis of student questionnaire for professional improvement plan*
➢ *B7-Take professional decisions in wide range of professional situations*	*B7.Comparing different biosensors for capturing bioelectrical signals.*

➤ *C1-Competent in all basic and some of the advanced professional skills (to be determined according to the specialty board/ department)*	C1. Practice on different aspects in neuorophysiology. C5. Sketch various medical devices used in operation room or in hospitals. C7. Demonstrate different aspects in bioelectric phenomena.
➤ *C2-Write and appraise reports*	C3. Practice on writing a research protocol.
➤ *C3-Evaluate methods and tools used in specialty*	C2. Design physiological models on MATLAB simulink software. C4-Apply different various signal processing techniques for extracting biosignal features. C6. Practice on using different technical computer programs used in hospital information system construction.
➤ ***D1-Communicate effectively using all methods***	D1- Develop skills in communication
➤ *D2-Use information technology to improve his/her professional practice*	D2- Use information technology to improve professional practice and use different sources of information to obtain data
➤ *D3-Practice self appraisal and determines his learning needs*	D3- Develop skills in self appraisal and seek continuous learning during preparation of thesis.
➤ *D4-Share in determination of standards for evaluation of others (e.g.: subordinates/ trainees etc.)*	D4.Develop skills of evaluating different scientific papers based on scientific regulations.

➢ *D5-Use different sources of information to obtain data*	*D5.Use of World Wide Web, digital libraries to obtain required data for research.*
➢ *D6-Work in teams*	*D6. Develop a culture of disseminating and sharing information with peers.*
➢ *D7-Manage time effectively*	*D7. Develop skill in time Management through giving oral presentation and sending required activities before deadline.*
➢ *D8-Work as team leader in situations comparable to his work level*	*D8- Election of students for representation in department's council.*
➢ *D9-Learn independently and seek continuous learning*	*D9- Use of resources (www, research articles,) other than lecture notes to master his research point during preparation of thesis.*

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	**13 hrs**	**-**

Second semester	6 hrs	6 hrs
Third semester	2 hrs	3 hrs

4.b.ii- No. of credit hours

Lectures	**21**	Practical	**9**	Total	**30**

Compulsory	**21**	Elective	**9**	Optional	**0**

4.b.iii- No. of credit hours of basic science courses   No. **3**   % **10**

4.b.iv- No. of credit hours of courses of social sciences and humanities.   No. **0**   % **0**

4.b.v- No. of credit hours of specialized courses   No. **27**   % **90**

4.b.vi- No. of credit hours of other courses   No. **0**   % **0**

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 hrs)

Code No.	Course Title	No. of credit hours	No. of hours /week	
			Lecture	Practical
1720701	Introductionto Biomedical Engineering	**4**	**3**	**2**
1720702	Bioelectric Phenomena	**3**	**2**	**2**
1720703	Biomedical Sensors.	**3**	**2**	**2**
1720704	Biomedical signal Analysis	**3**	**2**	**2**
1720705	DiagnosticImaging	**3**	**2**	**2**
1720706	Medical instruments ,and devices	**3**	**2**	**2**
1720712	Technical Report Writing and presentationskills	**2**	**2**	**0**

5.2- Elective I (9 hrs)

Code No.	Course Title	No. of credit hours	No. of hours /week	
			Lecture	Practical
1720707	prosthesis and Artifitcal Organ	3	2	2
1720708	Physiological Modeling simulation and control	3	2	2
1720709	Clinical Neurophysiology	3	2	2
1720710	Intensive Care Engineering	3	2	2
1720711	Medical Informatics	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 Devices*, 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.

Tool evaluation	Intended learning outcomes being assessed

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/ Nour El Din Ismail*
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. Ahmad Nashaat   Signature:………………………………

Department Head:
 Name: Prof**.** Dr. Saleh ElShehaby   Signature: ………………………………….

Date of Department Council Approval: 6/9/2017

ttach these Matrixes:

Program Aims vs ILOs matrix

PROGRAMME ILOS / AIMS	A1	A2	A3	A4	A5	A6	A7	A8	B1	B2	B3	B4	B5	B6	B7	B8	B9	B10
1. Demonstrate a comprehensive understanding of physical principles associated with biomedical engineering.	X			X	X	X			X									
2. Acquire a systematic understanding of physiological/bio medical measurements and statistics.										X	X		X		X			
3. Recognize the working principles behind the maintenance and management of biomedical instruments and safety procedures in a wide range of biomedical engineering applications.										X		X						

	C1	C2	C3	C4	C5	C6	C7	C8	C9	C10	C11	C12	C13	C14	C15
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	X								X	X

PROGRAMME ILOS AIMS	C1	C2	C3	C4	C5	C6	C7	C8	C9	C10	C11	C12	C13	C14	C15
1. Demonstrate a comprehensive understanding of physical principles associated with biomedical engineering.															
2. Acquire a systematic understanding of physiological/biomedical measurements and statistics.															

ILOS															
3. Recognize 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	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	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. Acquire a systematic understanding of physiological/biomedical measurements and statistics.												
3. Recognize 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

CourseTitle	Code ID	A1	A2	A3	A4	A5	A6	A7	A8	B1	B2	B3	B4	B5	B6	B7	B8	B9	B10

Course Title	Code ID	A1	A2	A3	A4	A5	A6	A7	A8	B1	B2	B3	B4	B5	B6	B7	B8	B9	B10
Introduction to Biomedical Engineering	1720701	X								X									
Bioelectric Phenomena	1720702						X												
Biomedical sensors	1720703										X								
Biomedical Signal Analysis	1720704											X							
Diagnostic Imaging	1720705																		
Medical Instruments and devices	1720706													X					
Prosthesis and Artificial Organs	1720707	X																	
Physiological Modeling, simulation and control	1720708			X															
Clinical Neurophysiology	1720709					X													
Intensive Care Engineering	1720710															X			
Medical Informatics	1720711							X											
Course Title	**Code ID**	**A1**	**A2**	**A3**	**A4**	**A5**	**A6**	**A7**	**A8**	**B1**	**B2**	**B3**	**B4**	**B5**	**B6**	**B7**	**B8**	**B9**	**B10**
Technical	1720712		X										X		X				

Course Title	Code ID	C1	C2	C3	C4	C5	C6	C7	C8	C9	C10	C11	C12	C13	C14	C15
Report Writing																
Ethical Issues Associated with the use of medical technology	1720713				X											
Design of Experiments	1720 714													X		
Security Systems	1720717						X								X	
Artificial intelligence and machine learning	1720718							X								X

Course Title	Code ID	C1	C2	C3	C4	C5	C6	C7	C8	C9	C10	C11	C12	C13	C14	C15
Introduction to Biomedical Engineering	1720701	X														
Bioelectric Phenomena	1720702		X													
Biomedical sensors	1720703			X												
Biomedical Signal Analysis	1720704				X											
Diagnostic Imaging	1720705					X										
Medical Instruments and devices	1720706						X									
Technical Report Writing and presentation skills	1720712															
Course Title	**Code ID**	C1	C2	C3	C4	C5	C6	C7	C8	C9	C10	C11	C12	C13	C14	C15

Course Title	Code ID	D1	D2	D3	D4	D5	D6	D7	D8	D9	D10	D11
Prosthesis and Artificial Organs	1720707			X								
Physiological Modeling, simulation and control	1720708				X							
Clinical Neurophysiology	1720709					X						
Intensive Care Engineering	1720710						X					
Medical Informatics	1720711							X				
Ethical Issues Associated with the use of medical technology	1720713								X			
Design of Experiments	1720714									X		
Security Systems	1720717										X	
Artificial intelligence and machine learning	1720718											X

Course Title	Code ID	D1	D2	D3	D4	D5	D6	D7	D8	D9	D10	D11

Course Title	Code ID	D1	D2	D3	D4	D5	D6	D7	D8	D9	D10	D11
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								
Medical Instruments and devices	1720706	X	X	X								
Technical Report Writing and presentation skills	1720712								X			
Prosthesis and Artificial Organs	1720707											
Physiological Modeling, simulation and control	1720708									X		
Clinical Neurophysiology	1720709										X	
Intensive Care Engineering	1720710											

Medical Informatics	1720711		X							X			
Ethical Issues Associated with the use of medical technology	1720713			X						X			
Design of Experiments	1720714												X
Security Systems	1720717	X											
Artificial intelligence and machine learning	1720718	X											

Program ILOs versus ARS FOR *Master* Degree in *Biomedical Devices*

PROGRAMME ILOS ARS	A1	A2	A3	A4	A5	A6	A7	A8
A1. Describe the functions of several physiological systems in human body.	X							
A2. Recognize different biomedical signals induced from human body.					X	X		
A3. Use of different signal processing techniques on biosignals for enhancing patient diagnosis.								X
A4- Recognize the main advance in the field of biomedical engineering			X					

A5-Recognize the ethical regulations associated with the use of medical devices.			X				
A6-Recognize the quality standards of the practice in the field of biomedical engineering.						X	
A7-Order the research method in details.	X						
A8-Identify intellectual property rights.	X						

PROGRAMME ILOS ARS	B1	B2	B3	B4	B5	B6	B7	B8	B9	B10
B1- Analyze biosignals using signal processing techniques.			X							
B2- Examine dynamic physiological systems using simulation modeling techniques.									X	
B3-Relate different information to solve professional problems through thesis				X	X		X			X
B4-Publish scientific papers through thesis										X
B5- Examine safety instructions associated with the use of medical devices.					X	X				
B6- Analysis of student	X									

questionnaire for professional improvement plan										
B7.Comparing different biosensors for capturing bioelectrical signals.	X									

PROGRAMME ILOS ARS	C 1	C 2	C 3	C 4	C 5	C 6	C 7	C 8	C 9	C 10	C 11	C 12	C 13	C 14	C 15
C1. Practice on different aspects in neuorophysiology.									X						
C2. Design physiological models on MATLAB simulink software.								X							
C3. Practice on writing a research													X		

ILOS	1	2	3	4	5	6	7	8	9	10	11
protocol.											
C4-Apply different various signal processing techniques for extracting biosignal features.			X								
C5. Sketch various medical devices used in operation room or in hospitals.	X		X		X	X	X			X	X
C6. Practice on using different technical computer programs used in hospital information system construction.								X		X	X
C7. Demonstrate different aspects in bioelectric phenomena.		X									

PROGRAMME ILOS / ARS	D1	D2	D3	D4	D5	D6	D7	D8	D9	D10	D11
D1- Develop skills in communication		X									
D2- Use information			X								

technology to improve professional practice and use different sources of information to obtain data												
D3- Develop skills in self appraisal and seek continuous learning during preparation of thesis.				X								
D4.Develop skills of evaluating different scientific papers based on scientific regulations.												
D5.Use of World Wide Web, digital libraries to obtain required data for research.						X				X		
D6. Develop a culture of disseminating and sharing information with peers.			X									
D7. Develop skill in time Management through giving oral presentation and sending required activities before deadline.	X		X								X	

D8- Election of students for representation in department's council.		X									
D9- Use of resources (www, research articles,) other than lecture notes to master his research point during preparation of thesis.				X	X	X	X	X	X		X

Teaching and Learning Methods Vs Courses Matrix

	1720701	1720702	1720703	1720704	1720705	1720706	1720712	1720707	1720708
Lecture	√	√	√	√	√	√	√	√	√
Practical/Clinical	√	√	√	√	√	√		√	√
Brainstorming					√		√	√	
Discussion Groups					√		√		
Problem Solving		√						√	√
Case Study									√
Field Training							√		
Role playing									
Training Workshops					√		√		
Self-Directed Learning	√	√			√	√	√	√	
e-learning									
Project			√	√			√		√

	1720709	1720710	1720711	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							