CONSISTENCY WITH NATIONAL QUALIFICATIONS FRAMEWORK NATIONAL QUALIFICATIONS FRAMEWORKFOR THE KINGDOM OF SAUDI ARABIA (NQF-KSA)

Program: Master of Science in Biomedical engineering
Department: Medical Equipment Technology
College: Applied Medical Sciences
Institution: Majmaah University

Introduction:

Majmaah University constantly directs all its potentials towards achieving the objectives of Ministry of Education of the Kingdom. Majmaah University ensures that the entire program functioning under the university focus on consistency with the qualifications of National Commission for Academic Accreditation & Assessment. The master program of science in biomedical engineering (MSc. BME) under the umbrella of College of Applied Medical sciences takes outmost concern to meet the requirements to satisfy the consistency with the Qualifications Framework. As the field of Biomedical engineering is one of the promising professions which needs highly qualified personnel to deliver the health care system to the citizens of Saudi Arabia. This demand has led the Department of medical equipment technology under College of Applied Medical sciences, Majmaah University to start a Master program in biomedical engineering (MSc. BME). MSc. BME program serve as a stepping stone on the career of the medical equipment technology students to improve their skills and guide them to pursue the systematic research training.

Consistency with the principal Elements in the Qualifications Framework:

The principal elements in the framework such as Levels, Credits and domains of learning are applied according to the requirement of National qualifications framework for Higher education in the Kingdom of Saudi Arabia.

Levels:

Department of medical equipment technology proposed to start the MSc. BME program. It is designated as **Level 7- Master** as per NQF. The program prepares the students to tackle the complex academic and professional issues, providing creative solutions and making sound professional judgments. The acquired qualification enables graduates of the Program to professionally practice as Biomedical engineering senior specialist in public and private hospitals and medical equipment companies after completing the licensing procedures with the professional bodies in the kingdom.

Credits:

The National qualification framework emphasis the practice of defined credit requirements for the academic study. MSc. BME program is offered as a full-time on-campus day-time program, requiring for graduation the successful completion of 39 credit hours, which are delivered in the form of lectures, and laboratories, and ending with successful defense of the master thesis.

Out of Thirty-nine (39) credits, Six (6) credits are assigned to the Mathematics and Basic Science courses, twenty three (23) credits are for the major courses associated with Advanced Biomedical engineering - graduate level, and four (4) credits for Research Methodology and Research Project and the master thesis which will be in the field with six (6) credits.

Domains of Learning Outcomes:

At beginning of the program, the domains of learning will be classified in to five categories as per the requirement of NQF. This has major implications for strategies of teaching, for student assessment, and for the evaluation of programs. MSc. BME Program will include the referred domains of learning to enable the teaching, learning and assessment process.

Table: 1 Learning Outcomes in Domains of old NQF (2018) Learning, Assessment Methods and Teaching Strategy of Master of Science in biomedical engineering (MSc. BME) program.

	NQF Learning Domains and Learning Outcomes	Teaching Strategies	Assessment Methods
A= Knowledge			
A1	To recognize the main concepts, principles and theories of biomedical engineering applications.	Interactive lecture-discussion	Written examinations Assignment rubric Concept/learning (essay writing)
A2	To determine the effect of biomedical engineering knowledge in developing research and professional practice.	Interactive lecture discussion	Written examinations Assignment rubric Concept/learning (essay writing)
B = Cognitive Skills			
B1	To apply practical and theoretical knowledge of biomedical engineering to deal with novel and unpredictable professional contexts.	Interactive lecture discussion Collaborative (teamwork; small group discussion) learning	Written examinations Assignment rubric Written output (project)
B2	To identify, formulate and solve biomedical engineering problems	Interactive lecture discussion Collaborative (teamwork; small group discussion) learning	Case study Assignment Essay writing / concept or learning paper rubric
B3	To develop significant novel ideas about biomedical engineering aspects	Interactive lecture discussion Collaborative (teamwork; small group discussion) learning	Case study Assignment Essay writing / concept or learning paper rubric
B4	To plan and execute a major research by applying practical and theoretical knowledge.	Interactive lecture discussion Collaborative (teamwork; small group discussion) learning	Case study Assignment Essay writing / concept or laboratory exam
C = Interpersonal Skills & Responsibility			
C1	To apply ethical principles and commit to professional ethics, responsibilities and norms of biomedical engineering practice	Collaborative (teamwork; small group discussion) learning Seminar-workshop conferences (application exercise)	Group project rubric Oral presentation rubric

C2	To function effectively as a member or leader in diverse teams in multi-disciplinary settings.	Collaborative learning (teamwork) Interactive lecture discussion	Project presentation Assignment
D = Communication, Information Technology & Numerical			
D1	Ability to understand and prepare effective reports.	Collaborative (teamwork; small group discussion) learning Interactive lecture-discussion	Oral presentation rubrics Written examination Group project rubric
D2	Ability to produce project documentation.	Seminar-workshop conferences (application exercise) Collaborative learning (teamwork) Technology-aided teaching	Project presentation rubric Oral presentation rubric
D3	Ability to communicate effectively with different kinds of audiences	Seminar-workshop conferences (application exercise) Collaborative learning (teamwork) Technology-aided teaching	Project presentation rubric Oral presentation rubric

Table: 2 The relationship between old NQF (2018) and biomedical engineering (MSc. BME) program in terms of levels, credits and domains of learning

	Level	**Minimum credit hours**	**Domains of Learning**			
Postgraduate						
National Qualification Frame work recommendations	5 Master	24 or 39 beyond Master plus thesis or project*	Knowledge	Cognitive Skills	Interpersonal Skills and Responsibility	Communication, IT and Numerical Skills
Master of Science in biomedical engineering (MSc. BME)	Level-5 Master	**39 credit hours,** which are delivered in the form of lectures, tutorials, and laboratories, and ending with successful defense of the master thesis in their chosen track.	**A1 and A2**	**B1, B2, B3 and B4**	**C1, C2**	**D1, D2 and D3**

Then the program transferred to 3 domain when NQF changed into SAQF (2019)

Table: 3. Learning Outcomes in Domains of Learning, Assessment Methods and Teaching Strategy of Master of Science in biomedical engineering (MSc. BME) program.

	SAQF Learning Domains and Learning Outcomes	Teaching Strategies	Assessment Methods
Knowledge and Understanding			
A1	To recognize the main concepts, principles and theories of biomedical engineering applications.	Interactive lecture-discussion	Written examinations Assignment rubric Concept/learning (essay writing)
A2	To determine the effect of biomedical engineering knowledge in developing research and professional practice.	Interactive lecture discussion	Written examinations Assignment rubric Concept/learning (essay writing)
Skills			
B1	To apply practical and theoretical knowledge of biomedical engineering to deal with novel and unpredictable professional contexts.	Interactive lecture discussion Collaborative (teamwork; small group discussion) learning	Written examinations Assignment rubric Written output (project)
B2	To identify, formulate and solve biomedical engineering problems	Interactive lecture discussion Collaborative (teamwork; small group discussion) learning	Case study Assignment Essay writing / concept or learning paper rubric
B3	To develop significant novel ideas about biomedical engineering aspects	Interactive lecture discussion Collaborative (teamwork; small group discussion) learning	Case study Assignment Essay writing / concept or learning paper rubric
B4	To plan and execute a major research by applying practical and theoretical knowledge.	Interactive lecture discussion Collaborative (teamwork; small group discussion) learning	Case study Assignment Essay writing / concept or laboratory exam
Competence			
C1	To apply ethical principles and commit to professional ethics, responsibilities and norms of biomedical engineering practice	Collaborative (teamwork; small group discussion) learning Seminar-workshop conferences (application exercise)	Group project rubric Oral presentation rubric

C2	To function effectively as a member or leader in diverse teams in multi-disciplinary settings.	Collaborative learning (teamwork) Interactive lecture discussion	Project presentation Assignment
C3	Ability to understand and prepare effective reports.	Collaborative (teamwork; small group discussion) learning Interactive lecture-discussion	Oral presentation rubrics Written examination Group project rubric
C4	Ability to produce project documentation.	Seminar-workshop conferences (application exercise) Collaborative learning (teamwork) Technology-aided teaching	Project presentation rubric Oral presentation rubric
C5	Ability to communicate effectively with different kinds of audiences	Seminar-workshop conferences (application exercise) Collaborative learning (teamwork) Technology-aided teaching	Project presentation rubric Oral presentation rubric

Table: 4. The relationship between SAQF and biomedical engineering (MSc.BME) program in terms of levels, credits and domains of learning

	Level	**Minimum credit hours**	**Domains of Learning**		
Postgraduate					
National Qualification Frame work recommendations	7 Master	24 or 39 beyond Master plus thesis or project*	**Knowledge & Understanding**	**Skills**	**Values**
Master of Science in Biomedical Engineering (MSc. BME)	Level-7 Master	**39 credit hours,** which are delivered in the form of lectures, tutorials, and laboratories, and ending with successful defense of the master thesis in their chosen track.	**A1 and A2**	**B1, B2, B3 and B4**	**C1, C2, C3, C4 and C5**

Recently, in 2020 the program transferred to new 3 domains when SAQF changed into NATIONAL QUALIFICATIONS FRAMEWORK FOR THE KINGDOM OF SAUDI ARABIA (NQF-KSA) (2021).

NQF-KSA: The education which a learner needs, including the necessary knowledge, understanding, skills, and values to obtain the relevant qualifications organized according to each level specified in the Framework. These levels progress gradually in terms of scope and sequence, from the entry level to level 8.

Table: 5. Learning Outcomes in Domains of Learning, Assessment Methods and Teaching Strategy of Master of Science in biomedical engineering (MSc. BME) program.

	SAQF Learning Domains and Learning Outcomes	Teaching Strategies	Assessment Methods
Knowledge and Understanding			
A1	To recognize the main concepts, principles and theories of biomedical engineering applications.	Interactive lecture-discussion	Written examinations Assignment rubric Concept/learning (essay writing)
A2	To determine the effect of biomedical engineering knowledge in developing research and professional practice.	Interactive lecture discussion	Written examinations Assignment rubric Concept/learning (essay writing)
Skills			
B1	To apply practical and theoretical knowledge of biomedical engineering to deal with novel and unpredictable professional contexts.	Interactive lecture discussion Collaborative (teamwork; small group discussion) learning	Written examinations Assignment rubric Written output (project)
B2	To identify, formulate and solve biomedical engineering problems	Interactive lecture discussion Collaborative (teamwork; small group discussion) learning	Case study Assignment Essay writing / concept or learning paper rubric
B3	To develop significant novel ideas about biomedical engineering aspects	Interactive lecture discussion Collaborative (teamwork; small group discussion) learning	Case study Assignment Essay writing / concept or learning paper rubric
B4	To plan and execute a major research by applying practical and theoretical knowledge.	Interactive lecture discussion Collaborative (teamwork; small group discussion) learning	Case study Assignment Essay writing / concept or laboratory exam

Values, Autonomy and Responsibility			
C1	To apply ethical principles and commit to professional ethics, responsibilities and norms of biomedical engineering practice	Collaborative (teamwork; small group discussion) learning Seminar-workshop conferences (application exercise)	Group project rubric Oral presentation rubric
C2	To function effectively as a member or leader in diverse teams in multi-disciplinary settings.	Collaborative learning (teamwork) Interactive lecture discussion	Project presentation Assignment
C3	Ability to understand and prepare effective reports.	Collaborative (teamwork; small group discussion) learning Interactive lecture-discussion	Oral presentation rubrics Written examination Group project rubric
C4	Ability to produce project documentation.	Seminar-workshop conferences (application exercise) Collaborative learning (teamwork) Technology-aided teaching	Project presentation rubric Oral presentation rubric
C5	Ability to communicate effectively with different kinds of audiences	Seminar-workshop conferences (application exercise) Collaborative learning (teamwork) Technology-aided teaching	Project presentation rubric Oral presentation rubric

Table: 6. The relationship between NQF-KSA and biomedical engineering (MSc.BME) program in terms of levels, credits and domains of learning

	Level	**Minimum credit hours**	**Domains of Learning**		
Postgraduate					
National Qualification Frame work recommendations	7 Master	24 or 39 beyond Master plus thesis or project*	**Knowledge & Understanding**	**Skills**	**Values, Autonomy and Responsibility**

Master of Science in Biomedical Engineering (MSc. BME)	Level-7 Master	**39 credit hours,** which are delivered in the form of lectures, tutorials, and laboratories, and ending with successful defense of the master thesis in their chosen track.	**A1 and A2**	**B1, B2, B3 and B4**	**C1, C2, C3, C4 and C5**

General Requirements for Admission:

The following are admission requirements stipulated for the admission for the Master of Science in biomedical engineering based on National frame work qualification.

• The program is available to male students.

• Candidates must be a Saudi or an official grant for higher education if he is a non-Saudi.

• Candidates must have bachelor's degrees from Saudi Arabian universities or equivalent bachelor's degree from a wide variety of international universities. International qualifications for Saudi citizens must be certified and equivalent from Saudi ministry of education and must be attested for non-Saudi citizens from Saudi embassies / cultural missions.

• Provide at least two recommendation letters for admissions who have already taught. Employer's consent to study if he / she is employed. *

• Full time study of the master's program. *

• Have good morals and conduct and be medically fit. *

• Candidates must be submitted within the specified times of the Deanship and no applications shall be accepted after the specified date, whatever the reasons. *

• Candidates are required to attach the general abilities test to the university graduates, provided that the degree is not less than 70 degrees

Relationship between Credit Hours and Years of Study

Master of Science in biomedical engineering program is planned for two years which consists of two semesters in each year and a total of four semesters in two years. The first semester includes 11 credit hours to complete the core courses. The second and third second and third

semesters also includes 11 credit hours respectively. The fourth semester includes the thesis work and possess 6 credits. In total the 39 credits are distributed within four semesters which includes two academic years.

Table: 5 Program structure details

Course code	Course Title	Credit hours		
		Lecture	Practical /Tutorial/Labs	Total
Level 1				
BME 611	Mathematical Methods for Biomedical Engineers.	2	0	2
BME 612	Cellular and Molecular Biology.	1	1	2
BME 613	Human Anatomy & Physiology for Biomedical Engineers.	2	0	2
BME 614	Biomedical Sensors and Instrumentation.	2	1	3
BME 615	Research methodology	1	1	2
	Total Credits			**11**
Level 2				
BME 621	Biosignal Processing.	2	1	3
BME 622	Biomechanics and Biodynamics	2	0	2
BME 623	Physiological Modeling	2	0	2
BME 624	Healthcare Technology Management	2	0	2
BME 625	Research Project	0	2	2
	Total Credits			**11**
Level 3				
BME 631	Applied Medical Image Processing (2D and 3D)	2	1	3
BME 632	Rehabilitation Engineering (Prosthetics and Orthotics)	2	0	2
BME 633	Design Standards and Regulations for Medical Devices	2	0	2
BME 634	Biomaterials and Artificial Organs	2	0	2
BME 635	Hospital Planning, Organization and Management.	2	0	2
	Total Credits			**11**
Level 4				
BME 641	Thesis	0	6	6
	Master Total Credit hours			**39**

Relationship between Academic and Professional Requirements:

The students will be awarded the Master of Science in biomedical engineering program after completion of all the program requirements and successful defence of their master thesis.

Field Descriptors

The following arrangements are followed based on the recommendations of SAQF. The following table explains the Academic and professional strand followed.

Table: 6 Field Descriptors

Level	Academic Strand	Professional Strand
Level-7. Master	Master of Science	Biomedical engineering

The criteria recommended by the SAQF will be achieved and the learning domains will be assessed and ensured to be consistent with the descriptions of characteristics of Master program. Both direct and indirect assessment techniques will be utilized to ensure that the desired program outcomes will be achieved. The methods used for assessing learning domains for are exams, portfolios, long and short essays, analytical reports, group reports, lab reports, debates, peer evaluations, demonstrations, discussion forums, interviews. The students will learn to demonstrate the manual dexterity skills, to perform elements of examination, evaluation, and intervention in a timely manner.

Conclusion:

The MSc. BME program is developed within the consistency of National qualification framework which leads to the knowledge, generic skills and professional expertise. This program offers knowledge and skills needed for professional practice in the Kingdom of Saudi Arabia. It also prepares the student to compete with all other students globally to excel in the field of Biomedical engineering. We assure you that the MSc. BME program of Department of Medical equipment technology will strictly abide the educational policies and cultural norms of Saudi Arabia.