Self-Assessment Report for Biomedical Engineering Department/ College of Engineering University of Thi-Qar 2019/2018

1. BACKGROUND INFORMATION

1.1 Contact Information

The department works according to the University of Thi-Qar School of Engineering hierarchical base that is related to the MoHESR. The department can be reached through the school of engineering website and the related emails and having the following extension www.thiqaruni.org. The department can be reached through the following emails too:

info@eng.thiqaruni.org	عمادة كلية الهندسة
Hussein-tokan@utq.edu.iq	قسم هندسة الطب الحياتي

1.2 Program History

Self-Assessment Report (SAR) is being submitted for the first time, and as a result there is no history of previous visits to include.

1.3 Program Delivery Modes

There are two modes of BME program delivery. Both modes use the traditional classroom education system that is dependent by the Iraqi Ministry of Higher Education and Scientific Research (MoHESR). The difference is in the time of classes. There are the day time classes and the evening classes. Students admitted for free in the day time classes based on their average in the high school. While there are tuitions paid by students with lower high school average for the evening classes.

1.4 Options

BME program gives a Bachelor of Sciences in Biomedical Engineering in general. Currently, there are no specific areas of concentrations. However, we hope to develop some in the next few years.

1.5 Program Locations

BME program in both modes are in the main campus of university of Thiqar.

1.6 Public Disclosure

2. *ACCREDIATION CRITERIA*

2.1 Criterion 1: Program Educational Objectives (PEOs)

2.1.1 Strategic Planning:

The department strategy is reviewed and updated through the department faculty meetings and the school of engineering council meetings. The school of engineering council includes as its member the dean of the school, his two associates, and the heads of all other departments. The council is responsible for passing the university council directions and instructions to the school of engineering through a higher committee body represented by the university head and the deans of all other schools.

Another academic body that also passes some instructions and guidelines is the Council of Iraqi Engineering Schools Deans. Their instructions pass through MoHESR legal channels to help shaping a unified future views of engineering education in Iraq.

Education Strategy: The faculty member starts with providing his syllabus and clearly explains the following:

1. A tentative syllabus with the textbook used, allocated time to each topic, study material from the textbook that is related to that topic.
2. A schedule of the homework assignments release and due dates.
3. A schedule of suggested quizzes and exams.
4. The grade break out.

In addition to that the faculty member should use (if available) any (useful) feedback and suggestions given by students who have taken the course in previous academic terms. These suggestions may help the instructor in shaping the material toward the students' needs and the job market requirements. They help also in shedding light to the weak areas in the given course.

Learning Strategy: The instructor has a big role in attracting students to his/her lecture through adapting the following strategies:

1. Motivating individual student skills and abilities.
2. Using the modern education techniques, connecting the theory with the applications whenever feasible, and trying to use the multimedia to deepen the students understanding (if possible).
3. Creating discussion group(s).
4. Fairness among students.
5. Trying to overcome the gender obstacle by making mixed gender groups in the labs.
6. Using lecture notes prepared by the instructor.
7. Giving the opportunity to the students to discuss the lecture topics.
8. Keeping up with the students' grades so that no one is left behind.
9. Breaking the ice between the instructor and his/her students, so that students be comfortable in sharing their concerns about the course or any other related topics with the instructor.

10. Reducing memorizing and repetitive style of learning and focusing on out of box thinking. Also emphasizing the practical aspect of the theory is very important in keeping students' attention on.

Research Strategy: It can be subdivided into the following pillars:

Faculty Member: The faculty member has to submit his/her proposed research topics to the department specialized scientific committee to approve them.

Students: Several specialized scientific committees are responsible for matching between the required syllabus and the given one.

Department: Due to the urge need for very specialized majors in the BME dept., the department started a plan of supporting faculty members to pursue their PhD degrees in the needed fields.

School of Engineering: The school of engineering is responsible of putting long term strategies for all the departments and provide funding required to develop the staff and faculty members through continuing education workshops, funding postgraduate studies and opening postgraduate studies within the school itself. Its strategy is shaped by the community and the market needs.

The BME Dept. Vision:

The Biomedical Engineering Department is looking forward to build engineering knowledge and development of biomedical engineering solutions which contribute to improve health care in Iraq

The BME Dept. Mission:

1. Preparing well qualified biomedical engineers and researchers to serve the health institutions needs as well as the academic organization's needs.
2. The graduate students use their knowledge to solve practical biomedical problems within scientific, economic, social, environmentally friendly, and ethical framework.
3. Providing highly trained and qualified biomedical engineers.
4. Creating a productive and fruitful research environment in the biomedical field of study.
5. Preparing future scientific leaders through enhancing the students' leadership abilities and skills.

2.1.2 BME Program Educational Objectives

BME dept. objectives can be summarized as

1. Preparing students to serve their community by providing suitable scientific atmosphere that encourages their creativity and growth.
2. Contributing to the scientific research.

3. Employing technology for serving humanity through the interaction between the engineering sciences and the biomedical sciences. Figuring out new topics, methods, and ideas to serve humanity.
4. The BME dept. continuously collaborates with other researchers from outside the department and especially from the medical field to identify and address problems to solve in order to help the local community. It also encourages students to pursue ethical research path and promotes moral values inside them. Students with the highest ranks are encouraged and promoted.
5. Contributing positively to knowledge spreading in the society through holding conferences, open lectures, and meetings.
6. The department graduates are well prepared to enroll in prestigious graduate programs and research centers, locally and globally.

2.1.3 The Compliance of the BME Dept. PEOs with the School of Engineering and the University of Thiqar Mission

1. Starting new cooperation channels with internationally recognized schools in the biomedical engineering field.
2. Conducting research in the areas of rehabilitation engineering, artificial limbs, neuroscience, medical signal processing, and other related biomedical engineering fields to cope up with the revolution in this field.
3. Establishing a research lab through cooperation between the BME dept. and the Iraqi Ministry of Health.

School (College) of Engineering Objectives	BME Dept. PEOs					
	O_6	O_5	O_4	O_3	O_2	O_1
Preparing competent and well-prepared engineers that are able to serve the increasing needs of the society.	√		√	√	√	√
Providing professional consulting services and conducting experimental researches.	√	√			√	√

2.1.4 Program Constituencies

There are four pillars to the BME program

a. The students enrolled in the program.
b. The BME dept. faculty and staff.
c. MoHESR and all its related organizations.
d. Our program graduates and the organizations that hire them.

Each constituent above is related to the PEOs. The first two are the key to the educational process. The third point is the central authority in the Iraqi higher education system that sets the long run plans. Finally, our graduates and the organizations that hire them provide the feedback we need to develop our program to better serve the society.

2.1.5 Program Educational Objectives Review Process

The BME Dept. and in cooperation with the Quality Improvement Unit in the college of engineering perform evaluations and give recommendations at the end of each academic year.

1. Pointing the negative cases for some faculty members and guide them to avoid such mistakes in the future.
2. Updating the department curriculum whenever needed to cope with the technology advancements and the local society needs.

The BME dept. also in cooperation with current students, graduated students, and local institutions put plans for future courses or labs, set new research directions, hire specific expertise faculty members, and diagnoses the weak points to be avoided

2.2 Criterion 2: Graduate Outcomes

2.2.1 BME Dept. Graduate Outcomes

2.2.2 Graduate Outcomes and BME Program Educational Objectives

2.3 Criterion 3: Curriculum

2.3.1 Program Structure and Content

2.3.1.1 Study Plan

Currently, all courses listed below are required according to the rules of MoHESR. In the next year, the department will start applying the new courses system required by MoHESR. Students must spend at least 5 academic years and successfully pass these courses.

Biomedical Engineering

Academic Program

First Year

	First Semester	T	A	P	U	Second Semester	T	A	P	U
	Course Title	T	A	P	U	Course Title	T	A	P	U
1	Statics	2	2	-	2	Dynamics	2	2	-	2
2	Biology 1	2	-	2	3	Biology 2	2	-	2	3
3	Calculus I 1	3	1	-	3	Calculus I 2	3	1	-	3
4	Anatomy I 1	2	-	2	3	Anatomy I 2	2	-	2	3
5	General Physics	2	1	-	2	Medical Physics	2	1	-	2
6	English Language 1	1	1	-	1	Freedom and Democracy	1	1	-	1
7	Intro to Computer Programming 1	1	-	2	2	Intro to Computer Programming 2	1	-	2	2
8	Engineering Drawing 1	1	-	2	2	Engineering Drawing 2	1	-	2	2
9	Intro to Biomedical Engineering 1	3	-	-	3	Intro to Biomedical Engineering 2	3	-	-	3
		17	**5**	**8**			**17**	**5**	**8**	
	Total Hours		**30**			**Total Hours**		**30**		
	Total Units				**21**	**Total Units**				**21**
	Total Units For The Two Semesters = 42									

Second Year

	First Semester	T	A	P	U	Second Semester	T	A	P	U
	Course Title	T	A	P	U	Course Title	T	A	P	U
1	Arabic	1	1	-	1	Human rights	1	1	-	1
2	Math. II 1	3	1	-	3	Math. II 2	3	1	-	3
3	Anatomy II 1	2	-	2	3	Anatomy II 2	2	-	2	3
4	Chemistry 1	2	-	2	3	Biochemistry	2	-	2	3
5	Electric Circuits 1	2	-	2	2	Electric Circuits 2	2	-	2	2
6	Circuits Laboratory1	1	-	2	2	Circuits Laboratory2	1	-	2	2
7	Biomaterials Science 1	2	1	-	2	Biomaterials Science 2	2	1	-	2
8	Mechanics of Materials	2	1	-	2	Mechanics of the musculoskeletal System	2	1	-	2
9	Computing for BME 1 (Mat. lab)	1	-	2	2	Neural Engineering	1	-	2	2
		17	**4**	**8**			**17**	**4**	**8**	
	Total Hours		**29**			**Total Hours**		**29**		
	Total Units				**20**	**Total Units**				**20**
	Total Units For The Two Semesters = 40									

Third Year

	First Semester	T	A	P	U	Second Semester	T	A	P	U
	Course Title	T	A	P	U	Course Title	T	A	P	U
1	Analog Electronics	3	1	-	3	Digital Electronics	3	1	-	3
2	Signal Processing	2	-	2	3	Signals and Systems for BME	2	-	2	3
3	Systems Physiology 1	2	2	-	2	Systems Physiology 2	2	2	-	2
4	Engineering Analysis	2	2	-	2	Numerical Methods	2	2	-	2
5	Electromagnetic Fields	2	2	-	2	Rehabilitation Science and Eng.	2	2	-	2
6	Electronics Laboratory1	1	-	2	2	Electronics Laboratory2	1	-	2	2
7	Transport Phenomena for BME	3	-	-	3	Thermodynamics	3	-	-	3
8	Medical Optics in Engineering	2	2	-	2	Medical Lasers in Engineering	2	2	-	2
		17	**9**	**4**			**17**	**9**	**4**	
	Total Hours		**29**			**Total Hours**		**29**		
	Total Units				**19**	**Total Units**				**19**
	Total Units For The Two Semesters = 38									

Forth Year

	First Semester					Second Semester				
	Course Title	**T**	**A**	**P**	**U**	**Course Title**	**T**	**A**	**P**	**U**
1	Control Systems 1	2	1	2	3	Control Systems 2	2	1	2	3
2	Tissue Engineering	2	1	-	2	Design of Machine Elements	2	1	-	2
3	Engineering Systems	2	1	-	2	Microcontroller & Microprocessor	2	1	-	2
4	Biocomputers Design Lab 1	1	-	2	2	Biocomputers Design Lab 2	1	-	2	2
5	Medical Measurements Lab1	2	-	2	3	Medical Measurements Lab2	2	-	2	3
6	Biomedical Circuits & Electronics	2	2	-	2	Electronic Devices & Applications	2	2	-	2
7	Biom. Instrumentation Design I 1	3	1	-	3	Biom. Instrumentation Design I 2	3	1	-	3
8	Artificial Organs 1	2	1	-	2	Artificial Organs 2	2	1	-	2
		16	**7**	**4**			**16**	**7**	**4**	
	Total Hours		**29**			**Total Hours**		**29**		
	Total Units				**19**	**Total Units**				**19**
	Total Units For The Two Semesters = 38									

Fifth Year

	First Semester					Second Semester				
	Course Title	**T**	**A**	**P**	**U**	**Course Title**	**T**	**A**	**P**	**U**
1	Biomedical sensors 1	1	-	2	2	Biomedical sensors 2	1	-	2	2
2	Senior Design Project 1	2	1	2	3	Senior Design Project 2	2	1	2	3
3	Bioelectronics Design Lab 1	2	-	3	3	Bioelectronics Design Lab 2	2	-	3	3
4	Biomechanics Design Lab 1	2	-	2	3	Biomechanics Design Lab 2	2	-	2	3
5	Biom. Instrumentation Design II 1	3	1	-	3	Biom. Instrumentation Design II 2	3	1	-	3
6	Image Processing for the BME 1	2	-	2	3	Image Processing for the BME 2	2	-	2	3
7	Clinical Issues in BME Design	2	2	-	2	Statistics for Biomedical Engineer	2	2	-	2
		14	**4**	**11**			**14**	**4**	**11**	
	Total Hours		**29**			**Total Hours**		**29**		
	Total Units				**19**	**Total Units**				**19**
	Total Units For The Two Semesters = 38									

First Year											
	First Semester					Second Semester					
	Course Title	T	A	P	U	Course Title	T	A	P	U
1	Statics	2	2	-	2	Dynamics	2	2	-	2
2	Biology 1	2	-	2	3	Biology 2	2	-	2	3
3	Calculus I 1	3	1	-	3	Calculus I 2	3	1	-	3
4	Anatomy I 1	2	-	2	3	Anatomy I 2	2	-	2	3
5	General Physics	2	1	-	2	Medical Physics	2	1	-	2
6	English Language 1	1	1	-	1	English Language 2	1	1	-	1
7	Intro to Computer Programming 1	1	-	2	2	Intro to Computer Programming 2	1	-	2	2
8	Engineering Drawing 1	1	-	2	2	Engineering Drawing 2	1	-	2	2
9	Intro to Biomedical Engineering 1	3	-	-	3	Intro to Biomedical Engineering 2	3	-	-	3
		17	5	8			17	5	8	
	Total Hours		30			Total Hours		30		
	Total Units				21	Total Units				21
	Total Units For The Two Semesters = 42									

Statics. 4 cr. hrs.

Fundamentals of forces and force systems. Internal and external forces. Support reactions. Definition of a free-body diagram (FBD). Emphasis on development of FBD-drawing skills. Moment of a force. Force system resultants. Vector methods in two and three dimensions. Equilibrium analysis of particles and rigid bodies. Truss analysis by methods of joints and sections. Analysis of simple frames and machines. Analysis of friction. Centroids of composite areas and volumes. Resultants of distributed loads.

Dynamics. 4 cr. hrs.

Fundamentals of motion of particles and rigid bodies. Application of Newton's laws. Principles of position, velocity, and acceleration. Use of work-energy and impulse-momentum methods. Introduction to vibrations. Analytical and computational analysis of the kinematics and kinetics of planar multi-body mechanical systems. Vibration analysis of single degree of freedom systems. Engineering applications including dynamic balancing, vibration absorption and vibration isolation.

General Biology1 for 4 cr. hrs.

Ecology. Theory of evolution. Taxonomy. Animal diversity. Structures of biological molecules. Cell structure and function. Vertebrate animal anatomy, physiology, and development. 3 hrs. lec., disc.

General Biology1 for 4 cr. hrs.

Glycolysis and cellular respiration. Photosynthesis. Mitosis and meiosis. Mendelian and molecular genetics. Microbial diversity. Plant form and function. 3 hrs. lec., disc.

Calculus 1 for 4 cr. hrs.

Limits and continuity. The derivative with applications (Area, Volume). Hyperbolic function (the functions and their inverse, their relation to the logarithmic function, derivative). Line equation, Polar coordinates and parametric equation.

Calculus 2 for 4 cr. hrs.

Integration and its application (Area and Volume), Definite integration, Infinite integration, Method of integration, Arc length, surface area, vectors, vectors product, Matrix and determinant, Numerical integration.

General Physics. 3 cr. hrs.

Survey of classical physics for science and engineering majors. Kinematics in one and two dimensions. Newton's laws of motion and dynamics, including rotation of rigid bodies. Energy concepts in physical systems. Newton's law of universal gravitation. The first law of thermodynamics, harmonic motion, and Einstein's special relativity. A command of high school algebra, geometry and trigonometry is assumed. Requires the use of introductory calculus. 3 hrs. lec., 2 hrs. lab., 1 hr. dis.

A continuation of **General Physics**. A survey of classical electromagnetic theory, with an introduction to modern physics. Electricity and magnetism: Coulomb's law, Gauss' law, the electric field and the electric potential, DC circuits, Ampere's law, Faraday's law, electromagnetic waves. Classical and quantum waves, interference, thermodynamics and an introduction to statistical mechanics. 3 hrs. lec., 2 hrs. lab., 1 hr. dis.

Medical Physics. 3 cr. hrs.

Students learn how light, X-rays, radiopharmaceuticals, ultrasound, magnetic fields, and other energy probes are generated and how they interact with tissues and detectors to produce useful image contrast. Practical issues such as beam generation, dose limitations, patient motion, spatial resolution and dynamic range limitations, and cost-effectiveness will be addressed. Emphasis is placed upon diagnostic radiological imaging physics, including the planar X-ray, digital subtraction angiography mammography, computed tomography, nuclear medicine, ultrasound, and magnetic resonance imaging modalities.

Introduction to Biomedical Engineering Methods 1 for 3 cr. hrs.

Introduction to biomedical engineering design and problem solving using. Key elements include physiologic signals and data acquisition, instrumentation, graphics, measurement and error, teamwork and decision-making. Problem-solving elements will be applied to real-world biomedical problems introduced by practicing biomedical engineers as well as faculty.

Introduction to Biomedical Engineering Methods 2 for 3 cr. hrs.

Continuation of BIEN 1100. Key elements include modeling, fluid mechanics, rehabilitation engineering, and entrepreneurship. Problem-solving and design elements are applied to real-world biomedical problems introduced by practicing biomedical engineers as well as faculty.

Introduction to Computer Programming 1 for 3 cr. hrs

Introduction. MS-DOS operating system. Windows operating system.)Introduction to desktop , using the mouse, closing & open widows ،creating, selecting, finding, copying & moving files or folder). How to star any program. View. Insert. Format. Tools. Table. Introduction of computer science, Hardware, Input/output devices, CPU unit, ALU ،Memories, Ram,Rom,

Introduction to Computer Programming 2 for 3 cr. hrs

Operating system Windows, MS-DOS, Linux ،Word Office. Power point, Excel, Applications, Internet Viruses Software,H L languages ,C++ languages , Arithmetic , Algorithms , If ،if…else statement , For statement , Do… while statement , Switch statement , Break and continue statement , Functions , Array, Point.

Anatomy I 1 for 4 cr. hrs

Introduction (anatomy position, section and planes, anatomic directions). Upper limb Breast. Pectoral region. Brachial Plexus and its branches and their clinical applications. Scapular region (anastamoses around the scapula, muscles attaching the scapula to the trunk, muscles attaching the scapula to the humerus, movement of scapula). Axilla and Brachium. Lymphatic system, axillary lymph node. Joints or articulation (classification of joints according to their functions, structures).type of cartilaginous joints, synovial joints, shoulder joint (sternoclavicular joint, acromioclavicular joint).

Second year										
	First Semester					Second Semester				
	Course Title	T	A	P	U	Course Title	T	A	P	U
1	Arabic 1	1	1	-	1	Arabic 2	1	1	-	1
2	Math. II 1	3	1	-	3	Math. II 2	3	1	-	3
3	Anatomy II 1	2	-	2	2	Anatomy II 2	2	-	2	2
4	Chemistry 1	2	-	2	3	Biochemistry	2	-	2	3
5	Electric Circuits 1	2	-	2	2	Electric Circuits 2	2	-	2	2
6	Freedom and Democracy 1	1	1	-	1	Freedom and Democracy 2	1	1	-	1
7	Biomaterials Science 1	2	1	-	2	Biomaterials Science 2	2	1	-	2
8	Mechanics of Materials	2	1	-	2	Mechanics of the musculoskeletal System	2	1	-	2
9	Computing for BME 1 (Mat. lab)	1	-	2	2	Neural Engineering	1	-	2	2
		17	5	8			17	5	8	
	Total Hours		29			Total Hours		29		
	Total Units				18	Total Units				18
	Total Units For The Two Semesters = 36									

Calculus for 4 cr. hrs.

Three-dimensional analytic geometry including parametric equations, vectors and vector functions. The differential and integral calculus of functions of several variables.

Differential Equations for Biomedical. 4 cr. hrs.

Methods and techniques for solving differential equations and systems of differential equations, with applications to biomedical and civil engineering. Restricted to students in BIEN or CEEN.

General Chemistry 4 cr. hrs.

Introductory college chemistry. Fundamental principles of chemistry including stoichiometry, physical states of matter, energy relationships, periodic table, atomic and molecular structure and solutions. The following mathematical concepts are used in CHEM 1001 and CHEM 1002: Scientific notation, logarithms, the quadratic equation and proportionality. 3 hrs. lec., 3 hrs. lab., 1 hr. disc.

Continuation of CHEM 1001. Chemistry of metals and nonmetals, kinetics, chemical equilibrium, aqueous equilibria, free energy relationships, electrochemistry, nuclear chemistry, organic chemistry, and chemistry of the transition metals. Qualitative analysis included as part of the laboratory work. 3 hrs. lec., 3 hrs. lab., 1 hr. disc.

Biochemistry 4 cr. hrs.

Major themes in biochemistry are examined in the context of mammalian physiology. Topics include: protein structure and enzyme catalysis, carbohydrate and lipid metabolism in relation to energy production, protein and nucleic acid synthesis, and the nature of the genetic code. 3 hrs. lec., disc.

Electric Circuits 4 cr. hrs.

Ohm's law and Kirchhoff's laws. Mesh and loop analysis of resistive circuits with DC sources. Source transformations. Thevenin's and Norton's theorems. Natural and step response of first- and second-order circuits. Circuits with ideal op amps. **Circuits Laboratory :** Introduction to circuit design, construction, and test. The basics of circuit construction techniques and electronic test measurement skills are covered. Circuit components such as resistors, inductors, capacitors and op-amps are used. Emphasis placed on DC and transient response of circuits.

Electric Circuits 4 cr. hrs.

Sinusoidal steady-state analysis. Power in AC circuits. Linear and ideal transformers. Laplace transform methods and circuit analysis applications. Passive and active frequency-selective circuits. Balanced three-phase circuits. Two-port circuits. **Circuits Laboratory :** Circuit design, construction and test skills are expanded to include digital circuits and programmable logic devices as well as passive and active filters. Emphasis placed on DC, AC and transient response of circuits containing passive and active devices

Biomaterials Science and Engineering. 3 cr. hrs.

Designed to introduce the uses of materials in the human body for the purposes of healing, correcting deformities and restoring lost function. The science aspect of the course encompasses topics including: characterization of material properties, biocompatibility and past and current uses of materials for novel devices that are both biocompatible and functional for the life of the implanted device. Projects allow students to focus and gain knowledge in an area of biomaterials engineering in which they are interested.

Atomic structure of matter, types of bonding, crystallography, role of imperfections, and ionic diffusion. Electric, magnetic, dielectric, and semiconducting properties. Mechanical properties, corrosion, and phase diagrams.

Mechanics of Materials. 3 cr. hrs.

Concepts of stress, strain and deflection. Factor of safety. Mechanical properties of materials. Stress and deformation calculations for cases of axially loaded rods, torsion of circular shafts, beam bending and combined loading. Horizontal shear connectors in built-up beams. Area moment of inertia. Parallel-axis theorem. Introduction to beam design. Stress concentration. Stress transformation and principal stress calculation by Mohr's circle. Statically indeterminate analysis. Elastic buckling of columns.

Mechanics of the musculoskeletal System (Skeletal Tissue Mechanics)

Structure and Biomechanics of bone, cartilage, and skeletal muscle; dynamics and control of musculoskeletal system models. Prerequisite: consent of program.

Skeletal tissues—bone, cartilage, tendon and ligament—serve functions that are largely mechanical in nature and that are critical for our health. This course is structured around classical topics in mechanics of materials and their application to study of the mechanical behavior of skeletal tissues, whole bones, bone-implant systems, and diarthroidal joints. Topics include: mechanical behavior of tissues (anisotropy, viscoelasticity, fracture and fatigue) with emphasis on the role of the microstructure of these tissues; structural properties of whole bones and implants (composite and asymmetric beam theories); and mechanical function of joints (contact mechanics, lubrication and wear). Emphasis is placed on using experimental data to test and to develop theoretical models, as well as on using the knowledge gained to address common health related problems related to aging, disease, and injury.

Computing for BME 1 (Mat. lab). 2 cr. hrs.

Introductory hands-on experience in computer programming, MATLAB, and Solid Modeling and CAD for biomedical engineers. Involves learning linear programming in C and creating flow-charts to solve biomedical applications. Computing topics will include syntax, data types, control flow and algorithm development. Biomedical applications include analyzing physiological signals, biological event detection, and biomechanical analysis. Students learn how to use MATLAB to solve biomedical applications. Solid modeling and CAD will be studied in the context of biomedical engineering design. Laptop required.

Neural Engineering. 3 cr. hrs.

Basic principles of neural engineering, properties of excitable tissues, quantitative models used to examine the mechanisms of natural and artificial stimulation. Basic concepts for the design of neuroprosthetic devices for sensory, motor and therapeutic applications. Design issues including electrode type, biomaterials, tissue response to stimulating electrodes and stimulus parameters for electrical stimulation and artificial control. Examples of how engineering interfaces with neural tissue show increasing promise in the rehabilitation of individuals of neural impairment.

Anatomy II 1

Introduction to head, neck and neuroanatomy, skull, scalp (nerve, artery, layers), temporal fossa, intertemporal fossa, cranial cavity, the bone of the cranium, anterior cranial fossa, posterior cranial fossa, middle cranial fossa, parotid gland, thyroid gland, glosopharangeal nerve. vertebral column. Brain and meninges, muscle of facial expression, cervical fascia, caroted sheath, subclavian artery brachiocephalic trunk, cervical plexus,

Anatomy II 2

The triangle of the neck (anterior, suboccipital, digastric, submental, carotid, posterior), main artery of the neck (common carotid artery, external carotid artery, internal carotid artery), internal jagular vein and artery. Abdomen: abdominal wall, rectus sheath, ingunal canal, peritoneum, abdominal aorta and branches, celiac trunk, the azygos and hetrozygos veins, portal venous system. neuroanatomy, development of the brain, spinal cord, cerebral aquidate, arachnoid granulation, cerebraospinal fluid, pyramidal tract, spinothalamic tract, cranial nerve and their functional components, pain, temperature and light

Third Year

	First Semester					Second Semester				
	Course Title	T	A	P	U	Course Title	T	A	P	U
1	Analog Electronics	3	1	-	3	Digital Electronics	3	1	-	3
2	Signal Processing	3	-	-	3	Signals and Systems for BME	3	-	-	3
3	Systems Physiology 1	2	2	-	2	Systems Physiology 2	2	2	-	2
4	Engineering Analysis	2	2	-	2	Numerical Methods	2	2	-	2
5	Electromagnetic Fields	2	2	-	2	Rehabilitation Science and Eng.	2	2	-	2
6	Electronics Laboratory1	-	1	2	2	Electronics Laboratory2	-	1	2	2
7	Transport Phenomena for BME	3	-	-	3	Thermodynamics	3	-	-	3
8	Medical Optics in Engineering	2	2	-	2	Medical Lasers in Engineering	2	2	-	2
		17	10	2			17	10	2	
	Total Hours		29			Total Hours		29		
	Total Units				19	Total Units				19
	Total Units For The Two Semesters = 38									

Analog Electronics. 4 cr. hrs.

Analysis and design of analog electronic circuits. Low and high frequency models for both bipolar and field effect transistors. Design features and operating characteristics of integrated linear circuits with emphasis on operational amplifiers and op-amp circuits.

Digital Electronics. 4 cr. hrs.

Introduces students to the basic principles of digital circuit analysis and design. Topics covered include: Boolean Algebra, number systems, basic logic gates, standard combinational circuits, combinational design, timing diagrams, flip-flops, sequential design, standard sequential circuits and programmable logic devices.

Signals Processing. 3 cr. hrs. & Signals and Systems for Biomedical Engineering. 3 cr. hrs.

Mathematical models of continuous-time signals and systems are studied. The time domain viewpoint is developed for linear time invariant systems using the impulse response and convolution integral. The frequency domain viewpoint is also explored through the Fourier series and Fourier Transform. Basic filtering concepts including simple design problems are covered. Application of the Laplace transform to block diagrams, linear feedback and stability including Bode plots are discussed. The sampling theorem, the z-transform and the Discrete Fourier Transform are introduced. Examples of electrical, mechanical and biomedical signals and systems are used extensively throughout the course. 3 hrs. lec.

Systems Physiology 1. 3 cr. hrs. & Systems Physiology 1. 3 cr. hrs.

Analyses of the underlying physiologic and bioengineering aspects of the major cell and organ systems of the human from an engineer's point of view. Classic physiologic approaches used to introduce topics including cell functions, nervous system, nerve, muscle, heart, circulation, respiratory system, kidney, reproduction and biomechanics. Design problems including models of cell-organ-system function and problems in biomechanics illuminate topics covered. Computer techniques and relevant instrumentation are incorporated. Experts on related topics are invited to speak as they are available.

Numerical Methods of Mechanical Systems. 3 cr. hrs.

Numerical algorithms (math analysis, optimization, function approximation) for analysis and preliminary design of engineering systems. Development and use of MATLAB functions. Finite element software for solid modeling and analysis of elastic systems. 3 hrs. lec., 1 hr. lab.

Electromagnetic Fields. 4 cr. hrs.

Development and use of the point and integral forms of Maxwell's equations for static and quasi-static electric and magnetic fields with emphasis placed on the vector nature of these fields. Includes analytic and computational solutions to field's problems. The wave equation for E.M. fields is derived and discussed.

Development and use of Wave Equations as derived from Maxwell's equations to explain the propagation of electromagnetic waves. Includes treatment of physicaloptics, antennas, wave-guides and transmission lines

Rehabilitation Science and Engineering. 4 cr. hrs.

Presents an overview of biomedical engineering as it applies to Rehabilitation Engineering, specifically, the design and prescription of prosthetic limbs, orthotic devices, and seating and positioning systems. Topics include: medical terminology, musculoskeletal anatomy, muscle mechanics, soft tissue mechanics, gait/locomotion, amputation surgery, lower extremity prosthetics, lower extremity orthotics, hand function, electromyography, upper extremity prosthetics, upper extremity orthotics, seating and positioning, and assistive devices.

And

Introduces rehabilitation science as the study of tissue and functional change, including:overview of key human sensory modalities and neuromotor systems in the context of functional capabilities and human performance metrics; review of spontaneous recovery mechanisms in response to various types of tissue trauma; review of roles of genetics and gene transcription networks in pathology and functional recovery prognosis; and the concept of rehabilitative assessment and therapeutic interventions as an optimization problem. Also focuses on the use of assistive technology to enhance access to independent living and to optimize the delivery of rehabilitative healthcare services. Includes rehabilitation biomechanics of physical interfaces, use of access and usability engineering in product design and innovative assessment and intervention strategies for neurorehabilitation.

Electronics Laboratory. 3 cr. hrs.

Gaining experience in the design, assembly, testing, and trouble-shooting of analog electronic circuits. Experiments encompass a wide range of topics such as: amplifiers, filters, power supplies, power control, oscillators, and communication circuits. Transistors, op-amps, general purpose, and specific purpose devices are used. 1 hr. lec., 3 hrs. lab.

Transport Phenomena. 3 cr. hrs.

Applications of mass, momentum, and mechanical energy balances to biomedical fluid systems. Study of physiological phenomena with an emphasis on cardiovascular systems and blood rheology.

Thermodynamics. 3 cr. hrs.

Elementary principles of equilibrium thermodynamics of pure and mixed substances, including applications to systems and processes. Relationships between heat and work, the first law of thermodynamics, are applied to either open or closed systems, operating at either steady or unsteady conditions. Second law of thermodynamics is applied to assessing the efficiency of devices and systems.

Optics, Lasers and Spectroscopy in Engineering. 3 cr. hrs.

Topical overview on the uses of optics, lasers, and spectroscopic measurement techniques in engineering and scientific disciplines. Technical content includes basic principles of geometric optics, principles behind and characteristics of laser operation, and linear spectroscopy. Emphasis on absorption and emission techniques for sensor development.

Forth Year

	First Semester					Second Semester				
	Course Title	**T**	**A**	**P**	**U**	**Course Title**	**T**	**A**	**P**	**U**
1	Control Systems 1	2	1	2	3	Control Systems 2	2	1	2	3
2	Tissue Engineering	2	1	-	2	Design of Machine Elements	2	1	-	2
3	Engineering Systems	2	1	-	2	Microcontroller & Microprocessor	2	1	-	2
4	Biocomputers Design Lab 1	2	1	-	2	Biocomputers Design Lab 2	2	1	-	2
5	Medical Measurements Lab1	2	-	2	3	Medical Measurements Lab2	2	-	2	3
6	Biomedical Circuits & Electronics	2	2	-	2	Electronic Devices & Applications	2	2	-	2
7	Biom. Instrumentation Design I 1	3	1	-	3	Biom. Instrumentation Design I 2	3	1	-	3
8	Artificial Organs 1	2	1	-	2	Artificial Organs 2	2	1	-	2
		17	**8**	**4**			**17**	**8**	**4**	
	Total Hours		**29**			**Total Hours**		**29**		
	Total Units				**19**	**Total Units**				**19**
	Total Units For The Two Semesters = 38									

Control Systems. 5 cr. hrs.

Provides an introduction to the principles of control systems theory for biomedical engineers. Mathematical techniques to characterize and design control systems will be studied in the context of physiological, bioelectrical, biochemical and biomechanical systems. Topics include frequency and time-domain modeling of physiological control systems, feedback, stability, steady-state error, design, root-locus, state-space techniques, and nonlinear control. Simulation using MATLAB and Simulink will be used to provide hands-on experience in the design of biomedical control systems.

Tissue Engineering. 3 cr. hrs.

This course is an introduction to the field of tissue engineering. It is rapidly emerging as a therapeutic approach to treating damaged or diseased tissues in the biotechnology industry. In essence, new and functional living tissue can be fabricated by delivering cells, scaffolds, DNA, proteins, and/or protein fragments at surgery. This course will cover the advances in the fields of cell biology, molecular biology, material science and their relationship towards developing novel “tissue engineered” therapies.

This course is an introduction to the current status of, practice and advances in tissue engineering, the biomedical engineering discipline that applies science and technology to develop novel means for replacing damaged and/or diseased tissues of the body. The course focuses both on fundamental aspects of the field, specifically, cells, materials, biochemical and biophysical stimuli, which are pertinent to new tissue formation, and on select application examples, specifically, bone, cartilage, skin, and vascular tissues. Strategies used to address current challenges, pursue emerging opportunities and explore new directions are reviewed and discussed.

The goal of this course is for students to be able to give a presentation on a product of their choice related to tissue engineering. The lectures, discussions, and design exercises are designed to help you complete each of the following aspects of the project: (1) Motivation/Market Need, (2) Disease/Condition/Anatomy, (3) Design Specifications and Testing Methods, (4) Scientific Basis of Product Technology and (5) Ethical Issues / FDA. There is a final oral presentation at the end of the course.

Design of Machine Elements. 3 cr. hrs.

Detailed design of structural elements, shafts, gears, bearings, and other machine elements. Laboratory activities which cover the theoretical and experimental analysis of machine elements. 3 hrs. lec., 2 hrs. lab.

Detailed design of structural elements, shafts, gears, bearings, and other machine elements. Laboratory activities which cover the theoretical and experimental analysis of machine elements. 3 hrs. lec., 2 hrs. lab.

Engineering Systems. 3 cr. hrs.

Focuses on the modeling and solution of physical systems including translational and rotational mechanical systems, mass balance systems (fluids, chemical), thermal systems and electrical systems. Analytic solution techniques stress the universality of the mathematics for all systems. Computer solutions using MatLab and Simulink are used to further investigate the linear system behavior and to introduce non-linear system behavior.

Microcontroller & Microprocessor

Introduction to 8085A CPU architecture-register organization, addressing modes and their features. Software instruction set and Assembly Language Programming. Pin description and features. Instruction cycle, machine cycle, Timing diagram. Hardware Interfacing: Interfacing memory, peripheral chips (IO mapped IO & Memory mapped IO). Interrupts and DMA. Peripherals: 8279, 8255, 8251, 8253, 8237, 8259, A/D and D/A converters and interfacing of the same. Typical applications of a microprocessor. 16 bit processors: 8086 and architecture, segmented memory has cycles, read/write cycle in min/max mode. Reset operation, wait state, Halt state, Hold state, Lock operation, interrupt processing. Addressing modes and their features. Software instruction set (including specific instructions like string instructions, repeat, segment override, lock prefizers and their use) and Assembly Language programming with the same. Brief overview of some other microprocessors (eg. 6800 Microprocessor).cessors (eg. 6800 Microprocessor).

Biocomputers Design Lab 1. 3 cr. hrs.

Hands-on experience in software design and validation, microprocessors, computer architecture, real-time computing, embedded software, graphical user interface and networking. An emphasis on medical devices with embedded software and hardware.

Biocomputers Design Lab 2. 3 cr. hrs.

Continuation of BIEN 4280 with emphasis on high performance computing in workstation environments.

Biomedical Circuits and Electronics. 4 cr. hrs.

An experience in electrical circuits (AC and DC), electronic devices (Junction, Transistor, Operational, Amplifier) bridges, digital circuits and Boolean implementation, combinational and sequential logic, memories. Use of P-Spice software. Analysis and design.

Electronic Devices and Applications. 4 cr. hrs.

Electronic components are discussed including semiconducting diodes, bipolar junction transistors, field effect transistors, etc. These devices will be analyzed from their terminal characteristics and their behavior in representative electronic circuits. Applications for devices include simple power supply analysis and design, class A amplifier analysis including transistor biasing and stability analysis, simple digital logic gates, etc.

Biomedical Instrumentation Design. 4 cr. hrs.

Problems in instrumentation relating to physiological measurements in the laboratory and clinic. Electronic devices for stimulus as well as measurement of physiological quantities. Design of actual instruments. Features include mechanical design, accessory design and safety requirements.

Artificial Organs. 3 cr. hrs.

Analysis and design of replacements for the heart, kidneys, and lungs. Specification and realization of structures for artificial organ systems. Understand the individual and synergistic function of the major natural ("internal") organs. Understand the major organ replacement systems currently available. Understand the opportunities for, and the major problems associated with, replacing failed organs Cardiovascular system Renal system Pulmonary system (Lung disease; heart-lung bypass) Hepatic system Endocrine system Neural prostheses (Muscular-skeletal prostheses) Identify basic engineering approaches to organ replacement: Functional specification; Locational issues; Device-organism interface (impedance matching); blood access; alternatives to blood Temporal activity --intermittency and control; Energy issues; Biocompatibility and bioactivity Materials: Functional specifications Hemocompatibility Biocompatibility Hybrid system materials Design approaches: Conceptual specification Initial modeling (multi-scale approaches) Modeling during development; Allowance for subject variability Manufacturing Issues: Cleanliness, particle elimination Sterilization Smart packaging Regulatory (FDA) concerns: Animal testing Clinical testing . Specific systems to be studied in detail: Blood vessel replacements; ventricular assist devices; cardiopulmonary bypass systems; hemodialysis systems. Specific engineering/physical chemical concepts to be reviewed and applied: Convective and diffusive transport; phase and ligand-solution equilibria; serial rate processes; transport-coupled enzyme kinetics.

Fifth Year

	First Semester					Second Semester				
	Course Title	T	A	P	U	Course Title	T	A	P	U
1	Biomedical sensors 1	1	-	2	2	Biomedical sensors 2	1	-	2	2
2	Senior Design Project 1	2	1	2	3	Senior Design Project 2	2	1	2	3
3	Bioelectronics Design Lab 1	2	-	3	3	Bioelectronics Design Lab 2	2	-	3	3
4	Biomechanics Design Lab 1	2	-	2	3	Biomechanics Design Lab 2	2	-	2	3
5	Biom. Instrumentation Design II 1	3	1	-	3	Biom. Instrumentation Design II 2	3	1	-	3
6	Image Processing for the BME 1	2	-	2	3	Image Processing for the BME 2	2	-	2	3
7	Clinical Issues in BME Design 1	2	2	-	2	Clinical Issues in BME Design 2	2	2	-	2
		14	4	11			14	4	11	
	Total Hours		29			Total Hours		29		
	Total Units				19	Total Units				19
	Total Units For The Two Semesters = 38									

Biosensors 1. 3 cr. hrs. & **Biomedical sensors 2. 3 cr. hrs.**

This course provides graduate and undergraduate engineering students an in-depth knowledge of the growing and highly multidisciplinary field of biosensors and biophotonics. This course will survey a variety of methods to detect biological molecules using mainly optical and electrical transduction mechanisms. This is a course for those who wish to learn how to design Electrical / Optical MEMS/NEMS/Microsystems, and a good foundation for graduate research in the areas of biosensors, biophotonics, micro-nano photonics and cellular and molecular optical imaging. Emphasis will be placed on how they operate and under what circumstances they can be useful. Some pedagogical approaches will be introduced to make it easier to learn some of the cross-disciplinary material. Self-learning, gaining knowledge through team interactions and projects will be emphasized in this course.

Bioelectronics Design Lab 1. 5 cr. hrs.

Understanding the principles of operation, safe operating procedures and methods of medical instrument selection. Design of experiments to measure physiological parameters. Typical experiments include: electrical safety; myography; force measurement; operational amplifier characterization; active filter; respiration monitoring. Actual medical instruments used under approximate clinical conditions. Report writing. 2 hrs. lec., 3 hrs. lab.

Bioelectronics Design Lab 2. 5 cr. hrs.

Design of circuits used in research and clinical instrumentation. Experiments include the design, fabrication and evaluation of specific circuits. Typical projects include circuits used for: patient isolation from electrical hazard, measurement of heart rate, multiplexing and demultiplexing and analog to digital conversion. Design projects incorporating microprocessors are also included. Students required to submit reports. 2 hrs. lec., 3 hrs. lab.

Biomechanics Design Lab 1. 4 cr. hrs.

Intended for those students pursuing the Biomedical Engineering Biomechanics option. The application of principles of engineering mechanics, data acquisition and basic electronics in the design and utilization of biomechanical instrumentation. Principles of transduction, mechanics, sampling theory, strain, temperature, and flow measurement as applied to biomechanical systems. A background in data acquisition, electrical safety, operational amplifier and bridge circuits, and measurements is provided. Experiments investigate biomechanics of the musculoskeletal and cardiovascular systems and include design content. Report writing. 2 hrs. lec., 3 hrs. lab.

Biomechanics Design Lab 2. 4 cr. hrs.

Provides students with experience in the design and implementation of appropriate experimental procedures to analyze biomechanical problems. Students will become familiar with various types of advanced transducers which will be used in conjunction with data acquisition workstations to obtain thermal, flow, strain, and related physiological data from biomechanical systems. Topics include mechanical properties of active muscle; analysis of human motion; postural stability; thermal regulation; cardiovascular mechanics; stress distribution in skeletal system; and comparison of static and dynamic biomechanical responses to load. 2 hrs. lec., 3 hrs. lab.

Biomedical Instrumentation Design. 4 cr. hrs.

Problems in instrumentation relating to physiological measurements in the laboratory and clinic. Electronic devices for stimulus as well as measurement of physiological quantities. Design of actual instruments. Features include mechanical design, accessory design and safety requirements.

Image Processing for the Biomedical Sciences. 4 cr. hrs.

This course serves as an introduction to biomedical image processing. Topics explored included the human visual system, spatial sampling and digitization, image transforms, spatial filtering, Fourier analysis, image enhancement and restoration, nonlinear and adaptive filters, color image processing, geometrical operations and morphological filtering, image coding and compression image segmentation, feature extraction and object classification. Applications in diagnostic medicine, biology and biomedical research are emphasized and presented as illustrative examples.

Clinical Issues in Biomedical Engineering Design. 4 cr. hr.

Develops clinical literacy in areas including medical terminology, working with medical professionals, professional conduct in the clinical environment, operating room workflow, and the technical needs of surgeons, nurses, dentists, and others. Students observe procedures in the clinical environment and learn to listen, ask questions, and identify problems, unmet needs and opportunities for new product development. Students participate in field trips to obtain hands-on experience with various medical and dental devices. A project proposal for a new medical device or technology is required at the end of the course.

2.3.1.2 Alignment of the BME Curriculum with the BME PEOs

The BME program curriculum is based on the curriculum in similar prestigious BME departments in US, Europe, and UK universities. Each course syllabus is carefully chosen to build the students' scientific character and to increase their scientific curiosity. In addition, the program curriculum is dynamically changing based on the feedback received from students, graduates, and local organizations that hire our program students. It encourages students' critical thinking, serving the community, ability to propose new and original solutions, and ability to conduct scientific research.

2.3.1.3 Attainment of Graduate Outcomes

After successfully completing the BME dept. curriculum, students should be able to

1. Apply and use principles of electrical engineering, mechanical engineering, biological sciences, chemistry, mathematics and physics to biomedical problems.
2. Solve the biomedical engineering problems and enhance the existing solution methods.
3. Analyze and enhance current biomedical instruments and devices.
4. Design and innovate new medical devices and methods to help the society.

2.3.1.4 Prerequisite Structure

With the current curriculum, the prerequisite is that students must successfully pass the previous semester classes. A new chart is under planning in the MoHESR and will be implemented as soon as they release it.

2.3.1.5 Subject Area Requirements

2.3.1.6 Major Design Experience

In BME dept. students are exposed, through their five year of academic study, to many challenges and expertise to challenge their brains and motivates them. The major design experience that they get is their final year graduation project. It worth 10 credits (units) and their evaluation consists of three parts: presentation, poster, and a written report that must be defended. In this project, students tackle a challenging design problem and either analyze it or implement it.

2.3.1.7 Teaching and Learning Strategies

The BME dept. uses different tools to assess students' progress and understanding to the academic material. These are subdivided to

Students' Academic Evaluation: Students go through many exams to be qualified to progress to the next academic level. This process is done over 5-year period. Successful progressing ends with a B.Sc. in Biomedical Sciences. Students are academically evaluated through the following set of rules:

Theoretical and Lab Education:

1. The faculty members inform students in advance by the class syllabus that contains the topics to be covered, exams' dates, pre-requisites, textbooks and references, homework assignments, and the grade division.
2. In labs, the same procedure above is done. However, the nature of the exams can be different.
3. Depending on the nature of the class (theory, lab, or a mixture of both), students collect grades (40%, 50%, or 60%). These collected grades are given to the department examination committee and announced to all students. The faculty members also show clearly how their students' grades are calculated. Table 8 below shows how the grades are calculated.

4. Faculty members have the freedom to make extra students' assessments to enhance their students' grades.
5. Students' grades are announced with the exams' solutions, so that students know their weakness points and help students to strength them. Final grades are given to the Quality Enhancement Unit in the college.

weight on the final exam, classes that depend on a mixture of theory and lab have 50% of their grade weight on the final exam. Final exams are done on specially prepared and stamped papers distributed by the department examination committee. Exam papers are then given to the faculty members to grade them anonymously by removing students' names and encrypting them with special numbers recognized only by the department examination committee. Finally, after faculty members grade their students' exam papers, the department examination committee adds the final exam grades with the grades that students have collected throughout the academic semester to assign the final grades for each student in each course. Students are informed by their performance according to Table 9 below.

Table 1: Grades and their Equivalent Evaluations

Grade	Evaluation	Grade	Grade
90-100	Excellent	60-69	Above Average
80-89	Very Good	50-59	Average
70-79	Good	Less than 50	Failed (Weak)

Final Grades Evaluation by the Academic Departments and The College Council:

1. Students' final grades are discussed in each department and in some cases some recommendations of curves are done.
2. The college council reviews the results and can recommend curves in some classes if needed.
3. The university president receives the recommendations given by the colleges councils and reviews the results too. This is the final step in the decision processes.
4. The colleges councils and the departments' examination committees are informed by the university president final decisions. They implement his orders.
5. Students get their final grades without going in the details of the decision process.

Summer Training: Summer training is one of the requirements to the students to get their degree. It can be done in any hospital or medical center. A specialized committee from several faculty members is formed to follow up students' summer training and to choose suitable training places for students. The goal is to sharpen students' practical skills. There are two parts of summer training. The first part is done in the third year and the second part is in the fourth year.

The Graduation Project: Usually given in the last year of the academic study. Students must successfully finish it from the first attempt. Otherwise they must redo it in the next year. Several graduation projects are proposed in the beginning of the academic year by faculty members, then these projects are analyzed by the scientific committee in the department to see how much they fit with the department requirements. The last step is to announce these projects to students where they choose from them the closest one to their interests. Students are divided into teams of 2-3 students. The students' progress evaluation is done through a seminar after Spring Break, then a final defense is done by the end of the academic year.

_**Monitoring Students' Academic Progress:** In most colleges of engineering, exams are considered the used tool to assess students' academic progress and we do this too. There are also other tools that our faulty members use which are:

1. Student's activity in the class such as answering questions, contribution to the discussion …etc.
2. Student's commitment to the extra assignments allocated by faculty members.
3. Student's class projects and reports. These are important tools to make students explore what is behind the material given in the lecture and how to use it properly.
4. Student's attendance although there are times where it is difficult to attend because the unstable situation in general in Iraq.
5. Pop quizzes to measure students' preparedness.

2.3.2 Courses Learning Outcomes and Graduate Outcome

2.4: Criterion 4: Continuous Improvement

2.5: Students

2.5.1 Student Admission

The admission process is centralized according to general rules set by the Central Admission Office that follows to MoHESR as follows

1. College of engineering plans the number of students to be admitted for each new academic year and sends this plan to MoHESR.
2. MoHESR sends this plan with other plans received from other universities to the Central Admission Office which is the responsible party for the whole admission in the higher education in Iraq. The colleges are assigned to students by the Central Admission Office in MoHESR and the departments (such as the BME) are assigned by the college itself based on the students' ranking and the departments' needs.
3. The Central Admission Office in MoHESR assigns students, generally, based on their ranking and the universities available positions.
4. The Central Admission Office in MoHESR sends rosters to the universities contain students' names and their corresponding colleges.
5. The colleges subdivide the students into their departments using the following citeria:
   a. The departments' needs.
   b. Students' ranks.
   c. Freedom in choosing the department is given to the students if their parents (father or mother) are faculty members.

2.5.2 Student Performance and Progress

In the current system, prerequisites are enforced since students can not progress to the next academic year until they successfully pass the current one. Each student has four opportunities to pass each class and failing to do so results in dismissing them from the school. Students go through many types of assessments to pass to the next academic stage as explained in **Sec.2.3.1.7** above.

2.5.2 Student Transfer

Student can transfer from and to the BME dept. However, the rules of transfer are set by MOHESR. For an incoming student, an evaluation committee consists of 2 or 3 faculty members meets and study the curriculum that student brings from his/her old school and compare it with the one in the BME dept. This may result either of asking the student to take more classes if there is any courses deficiency. In this case student can go to the corresponding academic level with the extra courses to fill the gap or can be placed into a lower academic level to fix the deficiency. The other possibility is that the transfer student can go to the corresponding academic level if (s)he satisfies the courses required by the BME dept. In all the above cases, transfer of credit is done by the responsible committee.

2.5.4 Students' Advising and Extracurricular Activities

Students' advising is done through the Educational Guidance Committee that consists of several faculty members. There are also out of class activities such as field trips that consists of scientific part and social part. The scientific part is practiced through visiting institutions and organizations related to the biomedical engineering field. The social part is practiced through going to amusement parks or farms where students can relax and network with each other.

2.5.5 Graduation Requirements

Bachelor of Sciences in Biomedical Engineering is awarded to students after a minimum of 5 academic years where students through this period have passed many theoretical and lab exams and finished a certain number of credits. The minimum grade to pass is 50%. In addition, students must complete the summer training requirements in their third and fourth academic years. Faculty members make undeclared visits to closely follow up students' commitments to the summer training. In addition to these visits, there is a special form to be filled by the institution where students have done their training. Finally, students must successfully finish, submit, and defend a graduation project in their fifth academic year. The graduation project is evaluated through: 10% for the seminar (or poster), 50% final defense, and 40% by their supervisor.

The final rank (GPA) of each student is counted in the following way:

1. For each academic year, students' GPA is his (her) average based on each class units (academic credits) and the grade given in that class.
2. The final students average (GPA) is calculated as: 0.05* Student's average in the 1st year + 0.1* Student's average in the 2nd year + 0.15* Student's average in the 3rd year + 0.3* Student's average in the 4th year + 0.5* Student's average in the 5th year.

The academic study in the department has two types. The first type which is the old one and applied only to the 4th and 5th years students, is the academic year-long courses. For the rest stages (1st,2nd, and 3rd), it is based on two semesters, Fall and Spring. However, there is a second attempt to pass the failed classed in both systems. Students' graduation orders are issued in two dates depending on each student result. In other words, students who pass from the 1st attempt get their graduation orders in July, while students who pass from the 2nd attempt get their graduation orders in October.

2.6 Criterion 6: Faculty

2.6.1 Faculty Qualification

Table 2: Faculty Qualifications
Biomedical Engineering Program

Faculty Member Name	Highest Degree Earned, Field and Year	Scientific Rank [1]	Type of Academic Appointment[2] PS or TS[2]	FT or PT[3]	Years of Experience			Professional Registration/ Certification	Level of Activity[4] H, M, or L		
					Govt./Ind. Practice	Teaching	This Institution		Professional Organizations	Professional Development	Consulting/ work in industry

Complete table for each member of the faculty in the program. Add additional rows or use additional sheets if necessary. Updated information is to be provided at the time of the visit.

1. Code: P = Professor, ASP = Assistant Professor, L = Lecturer, ASL = Assistant Lecturer and O = Other.
2. Code: PS = Permanent Staff, TS = Temporary Staff.
3. FT = Full Time Faculty or PT = Part Time Faculty, at the institution.
4. The level of activity, high, medium or low, should reflect an average over the three years prior to the Campus visit.

2.6.2 Faculty Workload

Table 3: Faculty Workload Summary
Biomedical Engineering Program

Faculty Member Name	PT or FT[1]	Classes Taught (Course No./ Credit Hrs.) Term and Year[2]	Program Activity Distribution[3]			% of Time Devoted to the Program[5]
			Teaching	Research or Scholarship	Other[4]	

1. FT = Full Time Faculty or PT = Part Time Faculty, at the institution.
2. For the academic year for which the Self-Assessment Report is being prepared.
3. Program activity distribution should be in percent of effort in the program and should total 100%.
4. Indicate sabbatical leave, etc., under "Other."
5. Out of the total time employed at the institution.

2.6.3 Faculty Size

2.6.4 Faculty Development

2.6.5 Faculty Authority and Responsibility

Faculty members can propose elective courses to the curriculum. Required courses are set by the MoHESR. The program educational objectives are set by the MoHESR with deans of schools of engineering cooperation. The university president and the university council participate in making the general headlines for the schools' policies. The Quality Improvement Unit in college of engineering is the responsible party for attaining the graduate outcomes in cooperation with the scientific departments and in this case with the BME dept.

2.7 Criterion 7: Administrative Support

The administrative set of rules that are followed in the department are based on central, solid, and accumulated administrative expertise from different Iraqi ministries and higher education institutions that proved, over time, to be useful and productive. In general, the BME dept. suffers from lack in administrative staff and this is expected to be a long term problem unless more financial support is provided to the department.

2.7.1 Leadership and Administrative Services