جامعة المجمعة
Majmaah University

كلية العلوم الطبية التطبيقية
College Of Applied Medical Sciences

Medical Equipment Department

DEPARTMENT MANUAL

2013/2014

1 Introduction

Department of Medical Equipment Technology (MET) at CAMS Al-Majmaah offers Bachelor of Science (BS) degree program in Biomedical Equipment Technology. Biomedical Equipments Technology is an interdisciplinary field which not only integrates fundamental scientific knowledge with medicine and biology, but also stimulates the interaction of engineers from all of the traditional disciplines. From its early days focused on the development of medical devices, biomedical engineering has developed into an area of extreme breadth and diversity. Biomedical Equipment Technology Bachelor may work to develop biomedical instrument, write software to analyze medical data, or may choose careers in the medical device or biotech industry, might further continue on to pursue an academic or professional degree. Additionally, our graduates will have an understanding, appreciation and motivation for ethical responsibility at all levels (individual, organizational, societal) as well as an appreciation of the importance of lifelong learning.

2 Department Vision

Creativity and innovation in teaching medical devices technology, establishing local and national partnership and contribute to scientific research internationally.

3 Department Mission

To qualify distinctive and innovative competencies scientifically, skillfully and behaviorally in the field of medical equipment technology, and providing community services through an advanced academic environment.

4 Department Goals

- To provide students the education needed for a rewarding career in biomedical equipment technology
- To educate students with a solid foundation in biomedical technology sciences, which makes them highly qualified, nationally leaders in their specialties and internationally competitive.
- To promote the culture of self and continues learning among students, in order to be always updated to the fast growing technology development in Biomedical.
- To equip students with the skills needed for scientific research
- To provide supports to graduates, teachers, researchers, experts and consultants.

5 Biomedical Equipment Technology Program

5.1 Introduction

Medical technology is becoming increasingly important in health care. Our educational program focuses on the development of new biomedical technology for life science research and advanced health care. In addition, to traditional areas of mechanical and electrical engineering; Students will have the opportunity to take advanced courses that include medical instrumentation, biosensors, image processing, signal processing, instrumentation devices, nano-devices and nano-sensors. It provides a strong foundation in Engineering science and Informatics that flows smoothly into graduate studies in Biomedical Technology Sciences. This program gives the opportunity to students to see the interdependence of different biomedical engineering disciplines in the development of modern medical devices Individuals completing this program will be able to work as engineers in the rapidly expanding medical equipments, and systems industry. Others could pursue master program in biomedical fields, medical sciences or biomedical informatics. Using this background to enter any of these areas will assure a long-term appreciation of the interdisciplinary approach.

5.2 Program Educational Objectives

The BMET Program Educational Objectives (PEOs) provide the link between the program and the needs of stakeholders as well as a link between the program and the missions of the university and CAMS.

The BMET program education objectives are:

1. To achieve successful careers in biomedical instrumentation technology.
2. To become successful technical advisors, managers, and techno-entrepreneurs.
3. To pursue life-long learning and become successful educators for healthcare community through higher education and continual professional development.

5.3 Student outcomes

The BioMedical Equipment Technology program adopted the ABET technology accreditation commission (TAC) a-k general criteria student outcomes.

a- an ability to select and apply the knowledge, techniques, skills, and modern tools of the discipline to broadly-defined engineering technology activities;

b- an ability to select and apply knowledge of mathematics, science, engineering, and technology to engineering technology problems that require the application of principles and applied procedures or methodologies;

c- an ability to conduct standard tests and measurements; to conduct, analyze, and interpret experiments; and to apply experimental results to improve processes;

d- an ability to design systems, components, or processes for broadly-defined engineering technology problems appropriate to program educational objectives;

e- an ability to function effectively as a member or leader on a technical team;

f- an ability to identify, analyze, and solve broadly-defined engineering technology problems;

g- an ability to apply written, oral, and graphical communication in both technical and non-technical environments; and an ability to identify and use appropriate technical literature;

h- an understanding of the need for and an ability to engage in self-directed continuing professional development;

i- an understanding of and a commitment to address professional and ethical responsibilities including a respect for diversity;

j- a knowledge of the impact of engineering technology solutions in a societal and global context; and

k- a commitment to quality, timeliness, and continuous improvement.

5.4 Graduation Requirements

In order to obtain a bachelor degree in Biomedical Equipment Technology, a student has to successfully complete 140 credit hours which consists of:

Requirements	Credit Hours
MU General Courses	**12**
Unified Program for Health Colleges at MU	**26**
CAMS Core Courses	**12**
Program Courses	**90**
Internship (One full year)	**0**
Total Credit Hours	**140**

5.5 Program Courses

The Program courses consists of 30 mandatory courses and 6 elective courses. The student should select 3 among elective courses. The total credit hours for the program courses is 90 credit hours distributed as follows:

Course code	Course Name	Credit
BMTS 241	Electrical Circuits	**4**
BMTS 242	Computer & Systems	**2**
BMTS 243	Applied Mathematics 1	**2**
BMTS 244	Physics of Medical Equipment	**3**
BMTS 245	Electrical Skills	**2**
BMTS 246	Biomaterials	**2**
BMTS 351	Biomedical Analog Electronics 1	**4**
BMTS 352	Electrical Measurement	**2**
BMTS 353	Biomedical Mechanical Equipment 1	**3**
BMTS 354	Applied Mathematics 2	**2**
BMTS 355	Biomedical Digital Electronics 1	**3**
BMTS 361	Biomedical Analog Signal Processing	**2**
BMTS 362	Biomedical Analog Electronics 2	**3**
BMTS 363	Electromechanical Energy	**2**
BMTS 364	Biomedical Digital Electronics 2	**3**
BMTS 365	Biomedical Mechanical Equipment 2	**3**
BMTS 366	Computer Programming	**2**
BMTS 471	Biomedical Electronic Equipment 1	**3**
BMTS 472	Medical Imaging Systems 1	**3**
BMTS 473	Hospital Safety	**2**
BMTS 474	Medical Equipment Management & Maintenance	**2**
BMTS 475	Biomedical Equipment Design	**3**
BMTS 476	Biomedical Digital Signal Processing	**3**
BMTS 481	Computer Applications for Medical Systems	**3**
BMTS 482	Medical Imaging Systems 2	**3**
BMTS 483	Optical & Laboratory Medical equipment	**3**
BMTS 484	Biomedical Electronic Equipment 2	**3**
BMTS 48*	Elective course	**3**
BMTS 491	Biomedical Systems Control	**3**
BMTS 492	Digital Image Processing	**3**
BMTS 499	Graduation Project	**3**
BMTS 59*	Elective course	**3**
BMTS 59*	Elective course	**3**
	Total	**90**

(*) Elective Courses

Course code	Course Name	Credit
BMTS 485	Reverse Engineering for Medical Equipment	**3**
BMTS 486	Molecular Sensors & Nano-devices	**3**
BMTS 592	Digital Equipment design	**3**
BMTS 593	Artificial Intelligence	**3**
BMTS 594	Pattern Recognition	**3**
BMTS 595	Introduction to Telemedicine	3

5.6 Program Plan

Level 1				
Course Code	**Course Name**	**Credits**		**Prerequisite**
		Theo	**Lab**	
IC 101	Islamic Culture	**2**	**0**	
ARAB 101	Language Skills	**2**	**0**	
STAT 106	Biostatistics	**2**	**0**	
ENGL 131	English Listening & Speaking	**1**	**1**	
ENGL 132	English Reading	**1**	**1**	
ENGL 133	English Writing	**1**	**1**	
CT 140	**Computer Skills**	**0**	**3**	
Total Credit Hours		**9**	**6**	
		15		

Level 2				
Course Code	**Course Name**	**Credits**		**Prerequisite**
		Theo	**Lab**	
CHEM 105	General Chemistry for Health Sciences	**2**	**0**	
BIO 106	General Biology	**3**	**1**	
PHYS 106	General Physics for Health Sciences	**3**	**1**	
CHEM 106	Organic Chemistry for Health Sciences	**2**	**0**	
ENGL 134	English for Health Medical Purposes	**2**	**1**	
Total Credit Hours		**12**	**3**	
		15		

Level 3				
Course Code	**Course Name**	**Credits**		**Prerequisite**
		Theo	**Lab**	
IC 102	Islam and Society Structure	**2**	**0**	
ARAB 103	Arabic Editing	**2**	**0**	
CAMS 231	Human Anatomy & Physiology	**3**	**1**	**BIO 106**
CAMS 232	Mathematics for Health Sciences	**2**	**0**	
CAMS 233	Medical Terminology	**2**	**0**	
CAMS 234	Emergency Healthcare	**1**	**1**	
CAMS 235	Introduction to Pathology	**2**	**0**	
Total Credit Hours		**14**	**2**	
		16		

Level 4				
Course Code	Course Name	Credits		Prerequisite
		Theo	Lab	
IC 103	Economic System in Islam	2	0	
BMTS 241	Electrical Circuits	3	1	
BMTS 242	Computer & Systems	1	1	
BMTS 243	Applied Mathematics 1	1	1	CAMS 232
BMTS 244	Physics of Medical Equipment	2	1	CAMS 231
BMTS 245	Electrical Skills	1	1	
BMTS 246	Biomaterials	2	0	
Total Credit Hours		12	5	
		17		

Level 5				
Course Code	Course Name	Credits		Prerequisite
		Theo	Lab	
IC 104	Political System in Islam	2	0	
BMTS 351	Biomedical Analog Electronics 1	3	1	BMTS 241
BMTS 352	Electrical Measurement	1	1	BMTS 241
BMTS 353	Biomedical Mechanical Equipment 1	2	1	BMTS 244
BMTS 354	Applied Mathematics 2	2	0	BMTS 243
BMTS 355	Biomedical Digital Electronics 1	2	1	
Total Credit Hours		12	4	
		16		

Level 6				
Course Code	Course Name	Credits		Prerequisite
		Theo	Lab	
BMTS 361	Biomedical Analog Signal Processing	2	0	BMTS 354
BMTS 362	Biomedical Analog Electronics 2	2	1	BMTS 351
BMTS 363	Electromechanical Energy	1	1	BMTS 241
BMTS 364	Biomedical Digital Electronics 2	2	1	BMTS 355
BMTS 365	Biomedical Mechanical Equipment 2	2	1	BMTS 353
BMTS 366	Computer Programming	1	1	
Total Credit Hours		10	5	
		15		

Level 7				
Course Code	Course Name	Credits		Prerequisite
		Theo	Lab	
BMTS 471	Biomedical Electronic Equipment 1	2	1	BMTS 362,BMTS 364
BMTS 472	Medical Imaging Systems 1	2	1	
BMTS 473	Hospital Safety	2	0	
BMTS 474	Medical Equipment Management & Maintenance	1	1	BMTS 365
BMTS 475	Biomedical Equipment Design	2	1	BMTS 362,BMTS 364
BMTS 476	Biomedical Digital Signal Processing	2	1	BMTS 361
Total Credit Hours		11	5	
		16		

Level 8				
Course Code	Course Name	Credits		Prerequisite
		Theo	Lab	
BMTS 481	Computer Applications for Medical Systems	2	1	BMTS 366
BMTS 482	Medical Imaging Systems 2	2	1	BMTS 472
BMTS 483	Optical & Laboratory Medical equipment	2	1	
BMTS 484	Biomedical Electronic Equipment 2	2	1	BMTS 471
BMTS 48*	Elective Course	2	1	
Total Credit Hours		10	5	
		15		

Level 9				
Course Code	Course Name	Credits		Prerequisite
		Theo	Lab	
BMTS 491	Biomedical Systems Control	2	1	BMTS 476
BMTS 492	Digital Image Processing	2	1	BMTS 476
BMTS 499	Graduation Project	0	3	BMTS 475,BMTS 481 BMTS 482,BMTS 483 BMTS 484
BMTS 59*	Elective Course 1	2	1	
BMTS 59*	Elective Course 2	2	1	
Total Credit Hours		10	5	
		15		

Elective Courses				
Course Code	Course Name	Credits		Prerequisite
		Theo	Lab	
BMTS 485	Reverse Engineering for Medical Equipment	2	1	
BMTS 486	Molecular Sensors & Nano-devices	2	1	
BMTS 592	Digital Equipment design	2	1	
BMTS 593	Artificial Intelligence	2	1	
BMTS 594	Pattern Recognition	2	1	
BMTS 595	Introduction to Telemedicine	2	1	

Then one compulsory calendar year of internship training at affiliated hospitals before the student earns his Bachelor Degree of Applied Medical Sciences in Biomedical Equipment Technology.

5.7 Courses Brief Description

Level 4 Courses

Code & No : BMTS241
Course : Electrical Circuits
Credits : 3 lecture+1 lab
Pre-requisite : None
This course focus on principles of electricity including Resistive circuits, circuits theorems, nodal and mesh analysis, maximum power transfer theorem, source free inductive and capacitive circuits. It also focus on natural and forced response of RL and RC circuits, RLC circuits, sinusoidal natural and steady state response of RCL circuits, resonance, and introduction to AC quantities.

Code & No : BMTS242
Course : Computer and Systems
Credits : 1 lecture+1 lab
Pre-requisite : None
This course focuses on the computer system. It starts with an introduction to Computer Fundamentals, Information Processing Cycle, and Types of Computer Systems. It also studies System Software types, functions of Operating System, Popular Operating Systems and System Utilities. It focuses also on Motherboard, and Memories, Input/ Output and Storage Devices.

Code & No : BMTS243
Course: Applied Mathematics 1
Credits : 2 lecture
Pre-requisite : CAMS232
In this course student will study a review of some fundamental concepts in math used for biomedical technology. It includes fundamental operations on polynomials, linear equations, ratio and proportion variation and functions, system of linear equations, trigonometric functions and identities. It includes also, the exponential functions and their graphical representation, Logarithms, Logarithmic functions and their graphical representation, derivatives and application, integrals and application. It contains geometry limits and linear algebra.

Code & No : BMTS244
Course : Physics of Medical Equipment
Credits : 2 lecture+1 lab
Pre-requisite : CAMS231
The objective of this is course to provide an understanding of basics of physics, its relation with the biomedical phenomena, applications of the physics principles into biological systems. It includes units and dimensions of different physiological parameters, mechanic of particles, optics, sound and ultrasound. It contains also, fluids static and dynamic, gas laws, optics. It contains also isotopes, nature and properties of ionizing radiation, dose calculation, and electromagnetic radiation in medical instruments.

Code & No : BMTS245
Course : Electrical Skills
Credits : 1 lecture+ 1 lab
Pre-requisite : None
Throughout this course, student will know the basic hand tools, common electrical instruments used in design and production of electrical circuits. Student will learn circuit construction techniques starting by block and schematic diagrams till the production of the circuit. Student will also acquire basic skills in maintenance of electronic circuits, using advanced test equipment, and component testing and continuity checks, in order to find and fix faulty components in the biomedical instrument.

Code & No : BMTS246
Course : Biomaterials
Credits : 2 lecture
Pre-requisite : None
This course focuses on mechanical properties of biomaterials such as composite minerals, polymers, viscoelastic. It focuses also on synthetic replacement, and methods of linking the orthopedic organs with tissue and bone inside the body.

Level 5 Courses

Code & No : BMTS351
Course: Biomedical Analog Electronics 1
Credits : 3 lecture+1 lab
Pre-requisite : BMTS241
This course contain the basics of electronics, semiconductor diodes, diode applications, bipolar junction transistor (BJT), DC biasing BJT, Field- Effect Transistor, FET Biasing, BJT transistor modeling, BJT small signal analysis, FET small signal analysis. It contains also the use of transistor as amplifier in electronic circuits and application on biomedical instruments.

Code & No : BMTS352
Course : Electrical Measurements
Credits : 1 lecture+1 lab
Pre-requisite : BMTS241
This course focuses on the measurement devices and errors, system of units, and principle of different measurement devices. Student will study instruments such as: multi-meter, oscilloscopes and some others mechanical instruments measuring basic physical parameters such as strain, pressure and elasticity. Static and dynamic performance of instruments will be studied too.

Code & No : BMTS353
Course: Biomedical Mechanical Equipment 1
Credits : 2 lecture+1 lab
Pre-requisite : BMTS244
This course provides an understanding of the basics of mechanics, its relation with biomechanics, fields where biomechanics applies, establish the ability to use the basics of mechanics acquired and apply it to biomechanics systems in different areas. Stress-strain relationships and principal stress/strain components are investigated via Mohr's circle. It also covers the basics of fluid mechanics, and methods of pressure calculation and measurement on viscous and non-viscous basic fluid especially on blood flow in circulatory system as well as application of such principles in medical equipment.

Code & No : BMTS354
Course: Applied Mathematics 2
Credits : 2 lecture
Pre-requisite : BMTS243
This mathematics course focus on the function: function rule, the graph of a function, composition of functions, operation and characteristics of functions, periodic functions, linear functions, common biomedical engineering functions. It covers also, differentiation, higher derivatives, logarithmic differentiation, maximum and minimum of a function, integration and operation, area bounded by a curve. The calculation of centers of mass, moment of inertia, length of a curve and the area of a surface of revolution, Mean and root-mean-square value of a function, basic concepts of differential equations, solving first and second order of linear and differential equations will also be covered.

Code & No : BMTS355
Course: Biomedical Digital Electronics 1
Credits : 2 lecture+1 lab
Pre-requisite : None
This course focuses on the basics of digital electronics which starts by introduction to the digital and analog systems, digital circuits, parallel and serial transmission. It also deals with logic gates and boolean algebra, design of combinational logic circuits, Memory, analog to digital conversion and vice versa, some application to biomedical devices will also be covered.

Level 6 Courses

Code & No : BMTS361
Course : Biomedical Analog Signal Processing
Credits : 2 lecture
Pre-requisite : BMTS354
This course provides understanding and design of signal processing system. It starts with sampling and quantization of continuous signal, operation on analog signal, shift left and right, folding, statistical measurement, convolution, correlation, Fourier series, Fourier Transform, Laplace Transform, system analysis using Fourier Transform, Frequency response of Filters and Filter design for noise reduction.

Code & No : BMTS362
Course : Biomedical Analog Electronics 2
Credits : 2 lecture+1 lab
Pre-requisite : BMTS351
This course is an advance electronic which focus on integrated circuits and application to biomedical instrumentation. It starts with introduction to integrated circuits, and then it deals with operational amplifier; such as summing amplifier, inverter, non-inverting amplifier, integrator, differentiator, comparator, Oscillator, instrumentation amplifier and analog active filters.

Code & No : BMTS363
Course : Electromechanical Energy
Credits : 1 lecture+1 lab
Pre-requisite : BMTS241
This course is focused on electromechanical energy used in biomedical technology. It includes the design, construction and performance of electrical machines in medical instrumentation. It covers also, Transformers, DC machines, step motor, single phase AC machines, special motors, and drives systems. Application to biomedical system is covered too.

Code & No : BMTS364
Course : Biomedical Digital Electronics 2
Credits : 2 lecture+1 lab
Pre-requisite : BMTS355
This course focuses on advanced digital electronic circuits, including the architecture of Microprocessors and microcontrollers. Architecture of a specific 16 bit processor. Introduction to assembly language programming. Processor interface with memory and input/output interfacing techniques. Applications of microprocessors in biomedical instruments.

Code & No : BMTS365
Course : Biomedical Mechanical Equipment 2
Credits : 2 lecture+1 lab
Pre-requisite : BMTS353
This course focus on studying the mechanical instruments including the study of function and installation of mechanical instruments such as equipment for artificial respiration system, anesthesia, artificial kidney, foot and Upper-limb prosthetics and orthotics, normal and pathological function, some electro-mechanical equipment (Infusion pumps).

Code & No : BMTS366
Course : Computer Programming
Credits : 1 lecture+1 lab
Pre-requisite : None
This course focuses on C and C++ programming and application to biomedical systems. It includes also, data base programming SQL, database utilization for medical systems and patients information archiving with some application using PACS database software and others.

Level 7 Courses

Code & No : BMTS471
Course : Biomedical Electronic Equipment 1
Credits : 2 lecture+1 lab
Pre-requisite : BMTS362, BMTS364
This course deals with sensors in electrical instruments who receive, amplify, and process biomedical signals. It covers also the origin of bio-potentials and their parameters, introduction to ECG, EEG and EMG, bioelectric signals. Develop an ability to analyze biomedical instrument, the amplifiers and instrumentation amplifier, bio-potential electrodes.

Code & No : BMTS472
Course : Medical Imaging Systems 1
Credits : 2 lecture+1 lab
Pre-requisite : None
During this course the student will understand the principle of imaging modalities and technologies of different imaging instruments. This course focuses on two imaging modalities: X-ray and ultrasound instrument.

Code & No : BMTS473
Course : Hospital Safety
Credits : 2 lecture
Pre-requisite : None
Throughout this course, students understand hospital safety, types of hazards in hospital and their control, safety principles and standards, safety program and assurance.

Code & No : BMTS474
Course : Medical Equipment Management and Maintenance
Credits : 1 lecture+1 lab
Pre-requisite : BMTS365
This course contains an introduction to printed circuits boards, different design of electronic circuits, troubleshooting. instrument control program, preventive maintenance, failure reporting and recall, instrument selection and evaluation criteria, risk management techniques and resources, part inventory and control, equipment planning for medical facilities, application of computers in maintenance management

Code & No : BMTS475
Course : Biomedical Equipment Design
Credits : 2 lecture+1 lab
Pre-requisite : BMTS362, BMTS364
This course provides intensive coverage of the theory and practice of electromechanical instrument design with application to biomedical devices. Lectures will present techniques for designing electronic circuits as part of complete sensor systems. Topics covered include printed circuit board (PCB) design including component selection, PCB layout, assembly, and planning and budgeting for large projects. Design of electronic instruments with use of simulation software, emphasis on the use of integrated circuits, both analog and digital. Students practice the design and development in laboratory under supervision of teacher.

Code & No : BMTS476
Course : Biomedical Digital Signal Processing
Credits : 2 lecture+1 lab
Pre-requisite : BMTS361
Throughout this course student learn some digital signal processing techniques, including sampling and quantization, operation on digital signal, interpolation, decimation, shift, discrete convolution, correlation, discrete Fourier series and transform, Z-transform, application of Z-transform on biomedical signals, and finally digital filters design with some application.

Level 8 Courses

Code & No : BMTS481
Course : Computer Applications for Medical Systems
Credits : 2 lecture+1 lab
Pre-requisite : BMTS366
This course focus on computer application in biomedical area starting by introduction to biomedical data including data acquisition, storage, inputs-output interface, DICOM image format and types, image compressions. It covers also; essential concepts for biomedical informatics include database application, PACS software for patient data organization, data structure for biomedical systems.

Code & No : BMTS482
Course : Medical Imaging Systems 2
Credits : 2 lecture+1 lab
Pre-requisite : BMTS472
During this course the student understand the principle of advanced imaging modalities and understand technologies of different imaging instruments. This course focuses on many imaging modalities including Computed Tomography (CT), Nuclear Imaging, Combined PET-CT, open and closed MRI systems and finally PET-MRI system.

Code & No : BMTS483
Course : Optical and Laboratory Medical Equipment
Credits : 2 lecture+1 lab
Pre-requisite : None
This course focus on studying optical instrument starting by understanding the optical principles, operation of some laboratory and medical instruments. It covers light microscopy, emission and absorption spectrometry, flame spectrophotometer, flame photometers, endoscope instruments, laser instruments. It also provides an understanding of working principle of automated units, maintenance and calibration. Laboratory information and automation, Chromatography, Electrophoresis, Hematology, Automated chemical analyzers such as Synchron CX4, ACA, ROTO-CHEM, coulter counter.

Code & No : BMTS484
Course : Biomedical Electronic Equipment 2
Credits : 2 lecture+1 lab
Pre-requisite : BMTS471
The course focuses on studying several biomedical instrument including defibrillators, cardioverters, electrosurgical unit, pacemakers... Also it covers instrument and techniques dealing with electrophysiological signals like EEG, EMG and ENG. Cardiac output.

Level 9 Courses

Code & No : BMTS491
Course : Biomedical Systems Control
Credits : 2 lecture+1 lab
Pre-requisite : BMTS476
This course gives an introduction to physiological control systems for biomedical engineers. The main objective of this course is to expose student to the world of control systems with emphasis on important physiological systems. It starts with a review of the historical and philosophical aspects of physiological control systems. It covers also linear system theory and open- and closed-loop physiological control systems in homeostasis or steady state. It finishes by studying the time- and frequency-response of open- and closed-loop physiological control systems.

Code & No : BMTS492
Course : Digital Image Processing
Credits : 2 lecture+1 lab
Pre-requisite : BMTS476
This course deal with digital image processing on computer includes: statistics on the image, the notion of pixel, value representation in gray level images, color images, and operation on pixels for image enhancement. It covers also convolution application for different type of filters on images for noise reduction, enhancement using operation on histograms, linear and non-linear filters, image enhancement by histogram equalization; filter based on Fourier space and image restoration.

Code & No : BMTS499
Course : Graduation Project
Credits : 3 lab
Pre-requisite : BMTS475, BMTS481, BMTS482, BMTS483, BMTS484
This course consists of a research project under the supervision of a faculty member. The subject will be decided between the teacher and the students.

Elective Courses

Code & No : BMTS485
Course : Reverse Engineering for Medical Equipment
Credits : 2 lecture+1 lab
Pre-requisite : None
This course deals with reverse engineering which consist of design and development of existing biomedical instrument like ECG, heart pulse rate, oximeter, blood pressure measurement, pacemaker, defibrillators, etc. The student will replicate the instrument and test it.

Code & No : BMTS486
Course : Molecular Sensors and Nano-devices
Credits : 2 lecture+1 lab
Pre-requisite : None
The students will study the fundamental principles behind the operation of molecular sensors, nano-devices and biomedical microsystems elements; and major classes of molecular sensors, (or Micro-Electro-Mechanical Systems, MEMS). An application of molecular sensors, nano-devices and biomedical Microsystems is also covered.

Code & No : BMTS592
Course : Digital Equipment Design
Credits : 2 lecture+1 lab
Pre-requisite :
This course covers both software and hardware aspects of an 8086/8088 microcomputer system, including the microprocessor structure, its operation and control, the organization and interface requirements for a microcomputer system, the structures and operations of standard hardware components associated with a microcomputer system, assembly language programming and structure of the machine codes. Lab experiments associated with this course involve assembly program development, digital circuit design, fabrication, and testing.

Code & No : BMTS593
Course : Artificial Intelligence
Credits : 2 lecture+1 lab
Pre-requisite : None
This course introduces representations, techniques, and architectures used to build applied systems and to account for intelligence from a computational point of view. This course also explores applications of rule chaining, heuristic search, logic, constraint propagation, constrained search, and other problem-solving paradigms. In addition, it covers applications of decision trees, neural nets, Genetic Algorithm, and other learning paradigms.

Code & No : BMTS594
Course : Pattern Recognition
Credits : 2 lecture+1 lab
Pre-requisite : None
This course focuses on an introduction about pattern recognition, feature extraction, Euclidian distance, parametric and nonparametric decision theoretic classification methods, statistical discrimination functions, medical applications of pattern recognition, detailed examples.

Code & No : BMTS595
Course : Introduction to Telemedicine
Credits : 2 lecture+1 lab
Pre-requisite : None
Introduction, motivation, and overview; clinical applications; data dimensionality, acquisition, and conversion; transmission methods (wired, wireless); networking; compression; measurement of quality and accuracy; reception and display considerations; data archiving and retrieval; store-and- forward vs. interactive; privacy and security issues; potential benefits of telemedicine, challenges in telemedicine, global telemedicine activities, Tele medicine results ,commercial hardware and software; standards (including DICOM); economic issues; user-interface considerations; picture archiving and communication systems (PACS).

5.8 Where does BMET graduates work?

- Hospitals and Clinics
- Specialized Medical Companies
- Scientific Research Centres such as Universities
- Computer, networking and software companies
- Information System Management Companies
- Health Insurance Companies

6 Faculty Members

Faculty Name	Degree	Speciality	Rank	Nationality
Tarek Haweel	Ph.D.	Signal Processing	Prof.	Egypt
Santhanaraj Balakrishnan	Ph.D.	Biomedical Sciences	Asc. Prof.	India
Mohammad Al-Hawri	Ph.D.	Mathematical Analysis	Asc. Prof.	Jordan
Hedi Guesmi	Ph.D.	Electronic Sciences	Ast. Prof	Tunisia
Khemais Saada	Ph.D.	Tele-detection	Ast. Prof	Tunisia
Bakheet Alrasheedi	Ph.D.	Nanomaterial	Ast. Prof	Saudi Arabia
Eid Abdel Munem	Ph.D.	Medical Physics	Ast. Prof	Jordan
Khaled Aljarallah	Ph.D.	Bacteriology	Ast. Prof	Saudi Arabia
Jamel Smida	M.Sc.	Electrical Engineering	Lecturer	Tunisia
Kamel Smida	M.Sc.	Physics	Lecturer	Tunisia
Ali Messaoud	M.Sc.	Electronics	Lecturer	Tunisia
Anandh Bose	M.Sc.	Biomedical Engineering	Lecturer	India
Arimarden Anand	M.Sc.	Biomedical Instrumentation	Lecturer	India
Abdulrahman Al-Qahtani	M.Sc.	Biomedical Engineering	Lecturer	Saudi Arabia
Khaled Alshareef	M.Sc.	Biomedical Engineering	Lecturer	Saudi Arabia
Ahmad Alassaf	M.Sc.	Biomedical Engineering	Lecturer	Saudi Arabia
Vinoth Subramanian	M.Sc.	Technology	Lecturer	India

7 Department Laboratory

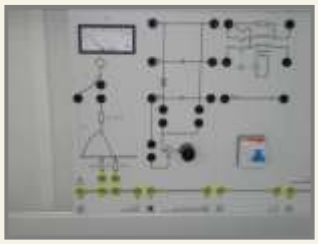
Medical Equipmennt Technology Department in the College of Applied Medical Sciences at Majmaah University provides eight laboratories for the practical part of the courses. They are as follows:

No	Laboratory Name	Code
1	Medical Electronics	1D1
2	Bio-Signals Processing	1D2
3	Electrical Skills	1D3
4	Medical Imaging	1D4
5	Medical Devices Workshop	1D5
6	Radiology	1D6
7	Bio-Physics	1D7
8	Advanced Medical Devices	1D8

Laboratory Name	**Medical Electronics**
Laboratory Code	**1-D-1**
Courses taught in the laboratory	▪ Biomedical Analog Electronics 1 ▪ Biomedical Analog Electronics 2 ▪ Biomedical Electronic Devices 1 ▪ Biomedical Electronic Devices 2
Skills Acquired in the laboratory	▪ Ability to understand the basic principles for electronic components like transistor and diode ▪ Knowledge of basic electronic elements ▪ Ability to use the tools used in the building and testing of electronic circuits ▪ Knowledge of the components, the properties and the applications of operational amplifiers ▪ Acquiring information about the various sensors used in electronic medical devices ▪ Identification of the theoretical principles of the working methods of the device, calibration methods and methods of determining faults ▪ Knowledge about how to use different types of testing devices, including multi-purpose digital scales and signal oscilloscope

Laboratory Name	**Bio-Signals Processing**
Laboratory Code	**1-D-2**
Courses taught in the laboratory	▪ Biomedical Digital electronics 1 ▪ Biomedical Digital electronics 2 ▪ Analog Signal Processing and System ▪ Digital Signal Processing
Skills Acquired in the laboratory	▪ Identification of the theory of operation of processor and logic gates. ▪ Programming of programmable integrated circuits ▪ Calibration of signals ▪ Learn how to build and test digital circuits ▪ Learn how to deal with digital and analog signals

Laboratory Name	**Electrical Skills**
Laboratory Code	**1-D-3**
Courses taught in the laboratory	▪ Electrical circuits ▪ Electrical Measurements ▪ Electromechanical Energy ▪ Electrical Safety
Skills Acquired in the laboratory	▪ Understanding the basic principles of function of electrical circuit components ▪ Learn the basic laws of the current and voltage in electrical circuits ▪ Analysis of electrical circuits ▪ Usage of ammeter and voltmeter ▪ Usage of signal generator, oscilloscope and power supply ▪ Familiarity with the various types of electrical motors and how to control them ▪ Ability to identify the risks associated with working in the medical field and how to prevent them ▪ Mastery of security principles for human operators working with medical devices



Laboratory Name	**Medical Imaging**
Laboratory Code	**1-D-4**
Courses taught in the laboratory	▪ Biomedical Electronic Instruments-1 ▪ Biomedical Electronic Instruments-2 ▪ Imaging Systems-1 ▪ Computer Imaging Processing ▪ Pattern Recognition
Skills Acquired in the laboratory	▪ Knowledge of the working principles of Ultrasound Imaging devices ▪ Knowledge of the working principles of X-ray Imaging ▪ Usage of contrasts in imaging ▪ Knowledge of the working principles of Fluoroscopy ▪ Comparison of modality X-ray vs. Ultrasound ▪ Learning the Radiation Hazard and Control

Laboratory Name	**Medical Devices Workshop**
Laboratory Code	**1-D-5**
Courses taught in the laboratory	▪ Electrical Skills ▪ Biomedical Mechanical Instruments 1 ▪ Biomedical Mechanical Instruments 2 ▪ Biomedical Instruments Design ▪ Project
Skills Acquired in the laboratory	▪ To obtain the necessary skills to use different types of hand tools (mechanical and electrical) and electronic instruments. ▪ To learn to distinguish between electrical and electronic parts and to design and manufacture a simple electrical circuit. ▪ To develop student skill to do the maintenance of medical devices using various tools.

Laboratory Name	**Radiology**
Laboratory Code	**1-D-6**
Courses taught in the laboratory	▪ Imaging Systems -1 ▪ Imaging Systems -2
Skills Acquired in the laboratory	▪ Knowledge of the working principle of Computed Tomographic Imaging in generations from 1-5 ▪ Knowledge of the working principle of Magnetic Resonance Imaging ▪ Usage of contrasts in imaging ▪ Knowledge of the working principle of Nuclear Imaging (Gamma Camera, Radio Pharmaceuticals, SPECT and PET) ▪ Comparison of CT modality vs. MRI, Nuclear Imaging vs. other modalities

Laboratory Name	**Bio-Physics**
Laboratory Code	**1-D-7**
Courses taught in the laboratory	▪ Physics of Medical Instruments ▪ Basic Imaging Systems ▪ Advanced Imaging Systems ▪ Biomedical Mechanical devices -1
Skills Acquired in the laboratory	▪ Recognize the importance of accuracy in physical measurement methods ▪ Analysis of the characteristics of physical concepts and their applications in the area of specialization ▪ The application principles of physics to provide safe health care ▪ Acquire the technical skills needed to operate the machines and devices according to physical laws

Laboratory Name	**Advanced Medical Devices**
Laboratory Code	**1-D-8**
Courses taught in the laboratory	▪ Optical and Laboratory Instruments ▪ Molecular Sensors and Nano-devices ▪ Biomedical Mechanical Instruments
Skills Acquired in the laboratory	▪ The student's understanding of important concepts in vital signs devices and surveillance equipment, surgical devices and medical imaging devices. ▪ Acquiring the theoretical principles of operation of devices and methods of calibration, installation and use of appropriate inspection tools.