University of Sana'a
Faculty of Engineering
Department: Biomedical Engineering
Title of the Program: Biomedical Engineering

Course Specification of Biomedical Equipment 2

Course Code (BE364)

I. Course Identification and General Information:						
1	**Course Title:**	Biomedical Equipment 2				
2	**Course Code & Number:**	BE364				
3	**Credit hours:**	C.H				TOTAL
		Th.	Seminar	Pr	Tr.	
		2	--	2	--	3
4	**Study level/ semester at which this course is offered:**	4th Level / 1st Semester				
5	**Pre –requisite (if any):**	Biomedical Sensors and Measurements (BE224), Biomedical Equipment 1 (BE263)				
6	**Co –requisite (if any):**	None				
7	**Program (s) in which the course is offered:**	Biomedical Engineering Program				
8	**Language of teaching the course:**	English				
9	**Location of Teaching the Course:**	Faculty of Engineering				
10	**Prepared by:**	Dr. Mohammed Al-olofi				
11	**Reviewed by:**	Dr. Waleed Al-Talbi				
12	**Date of Approval:**					

I. Course Description:

The course aims to introduce students the basic concepts, operating principles, and block diagrams of a variety of medical devices which are used in in deferent departments in hospital such as emergency, operation rooms, intensive care units and etc. . The students would be learned the skills for analyze,

repair, maintenance, and troubleshooting as well as using maintenance, test, and calibration tools. The course includes: ventilator, anesthesia, patient monitor, defibrillator, electrosurgical devices, infusion pumps, and syringe pumps. The course focuses on practical activities related to operating, calibrations, troubleshooting, and maintenance of such equipment.

III. Course Intended learning outcomes (CILOs) of the course (maximum 8CILOs)		**Referenced PILOs** (Only write code number of referenced Program Intended learning outcomes)
Knowledge and Understanding: Upon successful completion of the undergraduate Biomedical Engineering Program, the graduates will be able to:		
a1	Explain the basic concepts and principles for the medical treatment and therapy devices.	A1 Describe and explain the underlying mathematical methods and theories; life scientific-principles; and engineering core concepts related to the Biomedical Engineering context.
a2	Identify the operation principles, and design of medical treatment and therapy devices.	A2 Clarify the design principles and techniques and the engineering materials characteristics and how these are relevant to the developments and technologies in a biomedical systems context.
a3	Describe the clinical applications of medical treatment and therapy devices, their operational theories and their clinical environments.	A3 Recognize and explain the need for a high level of management, professional and ethical behavior, responsibility, quality assurance systems, codes of practice, standards, health and safety requirements, and environmental impacts in biomedical systems.
B. Cognitive/ Intellectual Skills: Upon successful completion of the undergraduate Biomedical Engineering Program, the graduates will be able to:		
b1	Design the medical treatment and	B3 Design the biomedical systems or processes within realistic constraints such as economic,

	therapy devices used in intensive care unit and operation theaters with considerate environmental conditions, health and safety, manufacturability and sustainability.	environmental, social, political, ethical, health and safety, manufacturability and sustainability.
b2	Categorize the medical treatment and therapy devices according to their specifications and features.	B5 Distinguish the main characteristics of biomedical systems, apply diagnostic skills and technical knowledge and perform failure analysis to these systems.
C. Professional and Practical Skills: Upon successful completion of the undergraduate Biomedical Engineering Program, the graduates will be able to:		
c1	Use mathematical, simulation models, and IT software packages to medical treatment and therapy devices effectively.	C2 Use a wide range of analytical tools, techniques, IT, modern engineering tools, software packages and develop required computer programs to solve, modeling and analyzing Biomedical Engineering problems.
c2	Construct, operate and maintain the medical treatment and therapy devices by using rules and regulations of industrial safety.	C4 Use rules and regulations of industrial safety as well as safe and diagnose systems at work, evaluate performance and observe the appropriate steps to manage risks concerning biomedical systems.
D. Transferable Skills: Upon successful completion of the undergraduate Biomedical Engineering Program, the graduates will be able to:		
d1	Function effectively in different work environments as an individual, and as a member or leader in multi-disciplinary teams.	D1 Lead and motivate individuals, show capability to work in stressful environments and within constraints, collaborate effectively within multidisciplinary team.

(A) Alignment Course Intended Learning Outcomes of Knowledge and Understanding to Teaching Strategies and Assessment Strategies:		
Course Intended Learning Outcomes	Teaching strategies	Assessment Strategies
a1 Explain the basic concepts and principles for the medical treatment and therapy devices.	• Interactive lectures & examples, • Tutorials, • Videos demonstrations, • Presentation/seminar, • Interactive class discussions, • Case studies, • Laboratory/Practical experiments based session, • Computer laboratory-based sessions, • Workshops practices, • Directed self- study, • Problem based learning, • Team work (cooperative learning), • Field visits/training, • Mini/major project.	• Written tests (mid and final terms and quizzes), • Short reports, • Lab\Project report • Practical lab performance assessment, • Coursework activities assessment, • Presentations.
a2 Identify the operation principles, and design of medical treatment and therapy devices.	• Interactive lectures & examples, • Tutorials, • Videos demonstrations, • Presentation/seminar, • Interactive class discussions,	• Written tests (mid and final terms and quizzes), • Short reports, • Lab\Project report • Practical lab performance

	• Case studies, • Laboratory/Practical experiments based session, • Computer laboratory-based sessions, • Workshops practices, • Directed self- study, • Problem based learning, • Team work (cooperative learning), • Field visits/training, • Mini/major project.	assessment, • Coursework activities assessment, • Presentations.
a3 Describe the clinical applications of medical treatment and therapy devices, their operational theories and their clinical environments.	• Interactive lectures & examples, • Tutorials, • Videos demonstrations, • Presentation/seminar, • Interactive class discussions, • Case studies, • Laboratory/Practical experiments based session, • Computer laboratory-based sessions, • Workshops practices, • Directed self- study, • Problem based learning, • Team work (cooperative learning),	• Written tests (mid and final terms and quizzes), • Short reports, • Lab\Project report • Practical lab performance assessment, • Coursework activities assessment, • Presentations.

	• Field visits/training, • Mini/major project.	

(B) Alignment Course Intended Learning Outcomes of Intellectual Skills to Teaching Strategies and Assessment Strategies:		
Course Intended Learning Outcomes	Teaching strategies	Assessment Strategies
b1 Design the medical treatment and therapy devices used in intensive care unit and operation theaters with considerate environmental conditions, health and safety, manufacturability and sustainability.	• Interactive lectures & examples, • Tutorials, • Videos demonstrations, • Presentation/seminar, • Interactive class discussions, • Case studies, • Laboratory/Practical experiments based session, • Computer laboratory-based sessions, • Workshops practices, • Directed self- study, • Problem based learning, • Team work (cooperative learning), • Field visits/training, • Mini/major project.	• Written tests (mid and final terms and quizzes), • Short reports, • Lab\Project report • Practical lab performance assessment, • Coursework activities assessment, • Presentations.
b2 Categorize the medical treatment and therapy devices according to their specifications and features.	• Interactive lectures & examples, • Tutorials, • Videos demonstrations,	• Written tests (mid and final terms and quizzes), • Short reports,

	• Presentation/seminar, • Interactive class discussions, • Case studies, • Laboratory/Practical experiments based session, • Computer laboratory-based sessions, • Workshops practices, • Directed self- study, • Problem based learning, • Team work (cooperative learning), • Field visits/training, • Mini/major project.	• Lab\Project report • Practical lab performance assessment, • Coursework activities assessment, • Presentations.

(C) Alignment Course Intended Learning Outcomes of Professional and Practical Skills to Teaching Strategies and Assessment Strategies:

Course Intended Learning Outcomes	Teaching strategies	Assessment Strategies
c1 Use mathematical, simulation models, and IT software packages to medical treatment and therapy devices effectively.	• Interactive lectures & examples, • Tutorials, • Videos demonstrations, • Presentation/seminar, • Interactive class discussions, • Case studies, • Laboratory/Practical experiments based session,	• Written tests (mid and final terms and quizzes), • Short reports, • Lab\Project report • Practical lab performance assessment, • Coursework activities assessment, • sPresentations.

	• Computer laboratory-based sessions, • Workshops practices, • Directed self- study, • Problem based learning, • Team work (cooperative learning), • Field visits/training, • Mini/major project.	
c2 Construct, operate and maintain the medical treatment and therapy devices by using rules and regulations of industrial safety..	• Interactive lectures & examples, • Tutorials, • Videos demonstrations, • Presentation/seminar, • Interactive class discussions, • Case studies, • Laboratory/Practical experiments based session, • Computer laboratory-based sessions, • Workshops practices, • Directed self- study, • Problem based learning, • Team work (cooperative learning), • Field visits/training, • Mini/major project.	• Written tests (mid and final terms and quizzes), • Short reports, • Lab\Project report • Practical lab performance assessment, • Coursework activities assessment, • Presentations.

(D) Alignment Course Intended Learning Outcomes of Transferable Skills to Teaching Strategies and Assessment Strategies:		
Course Intended Learning Outcomes	Teaching strategies	Assessment Strategies
d1 Function effectively in different work environments as an individual, and as a member or leader in multi-disciplinary teams.	• Interactive lectures & examples, • Tutorials, • Videos demonstrations, • Presentation/seminar, • Interactive class discussions, • Case studies, • Laboratory/Practical experiments based session, • Computer laboratory-based sessions, • Workshops practices, • Directed self- study, • Problem based learning, • Team work (cooperative learning), • Field visits/training, • Mini/major project.	• Written tests (mid and final terms and quizzes), • Short reports, • Lab\Project report • Practical lab performance assessment, • Coursework activities assessment, • Presentations.

IV. Course Content:

A – Theoretical Aspect:

Order	Units/Topics List	Learning Outcomes	Sub Topics List	Number of Weeks	contact hours
1	**Introduction of medical treatment**	a1	• Introduction of medical treatment and therapy devices,	1	2

	and therapy devices.		• Background on ICU, operation theaters.		
2	**Ventilator Machine**	a1, a2, a3	• Introduction and medical background on the respiration in human, • Types of design for mechanical ventilator, • principles of operation of ventilator machine,	1	2
3	**Ventilator Machine (Continue)**	a1, a2, a3, b1,b2, c1, c2	• design, block diagram, and components of ventilator machine, • ventilator modes, • maintenance and troubleshooting of ventilator machine	1	2
4	**Anesthesia Machine**	a1, a2, a3, b1,b2, c1, c2	• Introduction and medical back ground for anesthesia, • Types of medical gases used in anesthesia, • Principles of operation of anesthesia machine, •	1	2
5	**Anesthesia Machine (Continue)**	a1, a2, a3, b1,b2, c1, c2	• Design, block diagram, and components of anesthesia machine, • Maintenance and troubleshooting of anesthesia machine	1	2
6	**Patient Monitor**	a1, a2, a3, b1,b2, c1, c2	• Introduction and medical background on the bio-signal, • Types of design for patient monitor, • Principles of operation of patient monitor, • Design, block diagram, and components of patient monitor, • Maintenance and	1	2

			troubleshooting of patient monitor.		
7	**Electrosurgical**	a1, a2, a3, b1,b2, c1, c2	• Introduction and medical background on the electrosurgical, • Types of design for electrosurgical, • Principles of operation of electrosurgical,	1	2
8	**Mid-Term Theoretical Exam**	a1, a2, a3, b1,b2, c1, c2	- All Previous Topics	1	2
9	**Electrosurgical (Continue)**	a1, a2, a3, b1,b2, c1, c2	• Design, block diagram, and components of electrosurgical, • Maintenance and troubleshooting of electrosurgical.	1	2
10	**Defibrillator**	a1, a2, a3, b1,b2, c1, c2	• Introduction and medical back ground on the heart. • Abnormal signals of ECG, • Principles of operation for defibrillator, •	1	2
11	**Defibrillator (Continue)**	a1, a2, a3, b1,b2, c1, c2	• Design, block diagram, and components of defibrillator, • Maintenance and troubleshooting of defibrillator.	1	2
12	**Report & Presentation**	a1, a2, a3, b1,b2, c1, c2, d1	• 3 to 4 students make a report and presentation about one medical treatment and therapy devices.	1	2
13	**Report & Presentation (Continue)**	a1, a2, a3, b1,b2, c1, c2, d1	• 3 to 4 students make a report and presentation about one medical treatment and therapy devices.	1	2
14	**Infusion Pump**	a1, a2, a3, b1,b2, c1, c2	• Introduction and medical back ground of infusion systems.	1	2

			• Principles of operation for infusion pump, • Design, block diagram, and components of infusion pump, • Maintenance and troubleshooting of infusion pump.		
15	**Syringe Pump**	a1, a2, a3, b1,b2, c1, c2	• Introduction and medical back ground, • Principle of operation for syringe pump, • Design, block diagram, and components of syringe pump, • Maintenance and troubleshooting of syringe pump.	1	2
16	**Final Theoretical Exam**	a1, a2, a3, b1,b2, c1, c2	- All Topics	1	2
Number of Weeks /and Units Per Semester				**16**	**32**

B - Practical Aspect: (if any)

Order	Tasks/ Experiments	Number of Weeks	contact hours	Learning Outcomes
1	- Introduction to medical treatment, and therapy instruments.	1	2	a1, a2, a3
2	- Introduction to medical operation room and intensive care units.	1	2	a1, a2, a3
3	- Components of Ventilator equipment - Operation of Ventilator equipment	1	2	a1, a2, a3, b1,b2, c1, c2

4	- Detection of errors, troubleshooting, repair, and maintenance of Ventilator equipment	1	2	a1, a2, a3, b1,b2, c1, c2
5	- Components of Anesthesia Machine - Operation of Anesthesia Machine	1	2	a1, a2, a3, b1,b2, c1, c2
6	- Detection of errors, troubleshooting, repair, and maintenance of Anesthesia Machine	1	2	a1, a2, a3, b1,b2, c1, c2
7	- Midterm Practical Exam	1	2	a1, a2, a3, b1,b2, c1, c2
8	- Components of Patient monitor - Operation of Patient monitor Detection of errors, troubleshooting, repair, and maintenance of Patient monitor	1	2	a1, a2, a3, b1,b2, c1, c2
9	- Components of defibrillator - Operation of defibrillator - Detection of errors, troubleshooting, repair, and maintenance of defibrillator	1	2	a1, a2, a3, b1,b2, c1, c2
10	- Components of Electrosurgical unit - Operation of Electrosurgical unit - Detection of errors, troubleshooting, repair, and maintenance of Electrosurgical unit	1	2	a1, a2, a3, b1,b2, c1, c2
11	- Components of Infusion pump - Operation of Infusion pump	1	2	a1, a2, a3, b1,b2, c1, c2

	- Detection of errors, troubleshooting, repair, and maintenance of Infusion pump			
12	- Components of syringe pump - Operation of syringe pump - Detection of errors, troubleshooting, repair, and maintenance of syringe pump	1	2	a1, a2, a3, b1,b2, c1, c2
13	- Practical Project	1	2	a1, a2, a3, b1,b2, c1, c2, d1
14	- Practical Project (Continue)	1	2	a1, a2, a3, b1,b2, c1, c2, d1
15	- Final Practical Exam	1	2	a1, a2, a3, b1,b2, c1, c2
Number of Weeks /and Units Per Semester			**15**	**30**

V. Teaching Strategies of the Course:

- Interactive lectures & examples,
- Tutorials,
- Videos demonstrations,
- Presentation/seminar,
- Interactive class discussions,
- Case studies,
- Laboratory/Practical experiments based session,
- Computer laboratory-based sessions,
- Workshops practices,
- Directed self- study,
- Problem based learning,
- Team work (cooperative learning),

V. Teaching Strategies of the Course:

- Field visits/training,
- Mini/major project.

VI. Assessment Methods of the Course:

- Written tests (mid and final terms and quizzes),
- Short reports,
- Lab\Project report
- Practical lab performance assessment,
- Coursework activities assessment,
- Presentations.

VII. Assignments:

No	Assignments	Aligned CILOs(symbols)	Week Due	Mark
1				
2				
3				
4				
5				
Total				30

VIII. Schedule of Assessment Tasks for Students During the Semester:

No.	Assessment Method	Week Due	Mark	Proportion of Final Assessment	Aligned Course Learning Outcomes
1	**Quiz 1**	6	5	3.33%	a1, a2, a3, b2,c1, c2
2	**Midterm Practical Exam**	7	20	13.33%	a1, a2, a3, b2,c1, c2
3	**Midterm Theoretical Exam**	8	10	6.67%	a1, a2, a3, b2,c1, c2
4	**Report, Presentation, and Project**	10, 11	20	13.33%	a1, a2, a3, b2,c1, c2, d1
5	**Quiz 2**	12	5	3.33%	a1, a2, a3, b2,c1, c2
6	**Final Practical Exam**	15	30	20%	a1, a2, a3, b2,c1, c2
7	**Final Theoretical Exam**	16	60	40%	a1, a2, a3, b2,c1, c2
Total			150	100%	

IX. Learning Resources:

- *Written in the following order: (Author - Year of publication – Title – Edition – Place of publication – Publisher).*

1- Required Textbook(s) (maximum two).

1- Ed. Joseph D. Bronzino, 2016, **The Biomedical Engineering Handbook**, Fourth Edition, CRC Press LLC.

2- Roger Narayan, 2019, **Wiley Encyclopedia of Biomedical Engineering**, Elsevier.

2- Essential References.

1- James Moore, George Zouridakis, 2004, **Biomedical Technology and Devices Handbook**, CRC Press LLC.

2- Metin Akay, 2006, **Wiley Encyclopedia of Biomedical Engineering**, John Wiley &

	Sons, In. 3- John G. Webster, 2006, **Encyclopedia Of Medical Devices and Instrumentation**, Second Edition, John Wiley & Sons.
3- Electronic Materials and Web Sites *etc*.	
	Websites: 1- Medical Devices & Sensors Journal, Wiley. Peer reviewed academic journal in the field of Medical Devices. http://onlinelibrary.wiley.com/journal/2573802x 2- Journal of Medical Devices. Peer reviewed academic journal in the field of Medical Devices. http://medigitalcollection.asme.org/ **Journals:** 3- IEEE Transactions on Biomedical Engineering: Peer reviewed academic journal in the field of Biomedical Engineering. http://www.ieeexplore.ieee.org/xpl 4- Journal of Medical Devices. Peer reviewed academic journal in the field of Medical Devices https://publons.com/journal/19039/journal-of-medical-devices **Other Web Sources:** 5- Website: Franks Hospital Workshop http://www.frankshospitalworkshop.com

X. Course Policies:

1	**Class Attendance:** A student should attend not less than 75 % of total hours of the subject; otherwise he/she will not be able to take the exam and will be considered as exam failure. If the student is absent due to illness, he/she should bring a proof statement from university Clinic. If the absent is more than 25% of a course total contact hours, student will be required to retake the entire course again.

2	**Tardy:** For late in attending the class, the student will be initially notified. If he repeated lateness in attending class, he/she will be considered as absent.
3	**Exam Attendance/Punctuality:** A student should attend the exam on time. He/she is permitted to attend an exam half one hour from exam beginning, after that he/she will not be permitted to take the exam and he/she will be considered as absent in exam
4	**Assignments & Projects**: In general one assignment is given to the students after each chapter; the student has to submit all the assignments for checking on time, mostly one week after given the assignment.
5	**Cheating**: For cheating in exam, a student will be considered as fail. In case the cheating is repeated three times during his/her study the student will be disengaged from the Faculty.
6	**Plagiarism**: Plagiarism is the attending of a student the exam of a course instead of another student. If the examination committee proofed a plagiarism of a student, he/she will be disengaged from the Faculty. The final disengagement of the student from the Faculty should be confirmed from the Student Council Affair of the university or according to the university roles.
7	**Other policies**: - Mobile phones are not allowed to use during a class lecture. It must be closed; **otherwise** the student will be asked to leave the lecture room. - Mobile phones are not allowed in class during the examination. - Lecture notes and assignments might be given directly to students using soft or hard copy.

University of Sana'a
Faculty of Engineering
Department: Biomedical Engineering
Title of the Program: Biomedical Engineering

Template for Course Plan (Syllabus)

Biomedical Equipment 2- BE364

I. Course Identification and General Information:					
1	**Course Title:**	Biomedical Equipment 2			
2	**Course Code & Number:**	BE364			
3	**Credit Hours:**	**Credit Hours**	**Theory Hours**		**Lab. Hours**
			Lecture	**Exercise**	
		3	2	--	2
4	**Study Level/ Semester at which this Course is offered:**	4^{th} Level / 1^{st} Semester			
5	**Pre –Requisite (if any):**	Biomedical Sensors and Measurements (BE224), Biomedical Equipment 1 (BE263)			
6	**Co –Requisite (if any):**	None			
7	**Program (s) in which the Course is Offered:**	Bachelor of Biomedical Engineering			
8	**Language of Teaching the Course:**	English			
9	**Location of Teaching the Course:**	Faculty of Engineering			
10	**Prepared by:**	Dr. Mohammed Al-olofi			
11	**Reviewed by:**	Dr. Waleed Al-Talbi			
12	**Date of Approval:**				

II. Course Description:

The course aims to introduce students the basic concepts, operating principles, and block diagrams of a variety of medical devices which are used in in deferent departments in hospital such as emergency, operation rooms, intensive care units and etc. . The students would be learned the skills for analyze,

repair, maintenance, and troubleshooting as well as using maintenance, test, and calibration tools. The course includes: ventilator, anesthesia, patient monitor, defibrillator, electrosurgical devices, infusion pumps, and syringe pumps. The course focuses on practical activities related to operating, calibrations, troubleshooting, and maintenance of such equipment.

III. Course Intended Learning Outcomes (CILOs): (مخرجات تعلم المقرر)	
A. Knowledge and Understanding: Upon successful completion of the course, students will be able to:	
a1	Explain the basic concepts and principles for the medical treatment and therapy devices.
a2	Identify the operation principles, and design of medical treatment and therapy devices.
a3	Describe the clinical applications of medical treatment and therapy devices, their operational theories and their clinical environments.
B. Intellectual Skills: Upon successful completion of the course, students will be able to:	
b1	Design the medical treatment and therapy devices used in intensive care unit and operation theaters with considerate environmental conditions, health and safety, manufacturability and sustainability.
b2	Categorize the medical treatment and therapy devices according to their specifications and features.
C. Professional and Practical Skills: Upon successful completion of the course, students will be able to:	
c1	Use mathematical, simulation models, and IT software packages to medical treatment and therapy devices effectively.
c2	Construct, operate and maintain the medical treatment and therapy devices by using rules and regulations of industrial safety.
D. Transferable Skills: Upon successful completion of the course, students will be able to:	
d1	Function effectively in different work environments as an individual, and as a member or leader in multi-disciplinary teams.

IV. Course Contents:

A. Theoretical Aspect:

No.	Units/Topics List	Sub Topics List	Number of Weeks	Contact Hours
1	**Introduction of medical treatment and therapy devices.**	• Introduction of medical treatment and therapy devices, • Background on ICU, operation theaters.	1	2
2	**Ventilator Machine**	• Introduction and medical background on the respiration in human, • Types of design for mechanical ventilator, • principles of operation of ventilator machine,	1	2
3	**Ventilator Machine (Continue)**	• design, block diagram, and components of ventilator machine, • ventilator modes, • maintenance and troubleshooting of ventilator machine	1	2
4	**Anesthesia Machine**	• Introduction and medical back ground for anesthesia, • Types of medical gases used in anesthesia, • Principles of operation of anesthesia machine,	1	2
5	**Anesthesia Machine (Continue)**	• Design, block diagram, and components of anesthesia machine, • Maintenance and troubleshooting of anesthesia machine	1	2
6	**Patient Monitor**	• Introduction and medical background on the bio-signal, • Types of design for patient monitor, • Principles of operation of patient	1	2

IV. Course Contents:

A. Theoretical Aspect:

No.	Units/Topics List	Sub Topics List	Number of Weeks	Contact Hours
		monitor, • Design, block diagram, and components of patient monitor, • Maintenance and troubleshooting of patient monitor.		
7	**Electrosurgical**	• Introduction and medical background on the electrosurgical, • Types of design for electrosurgical, • Principles of operation of electrosurgical,	1	2
8	**Mid-Term Theoretical Exam**	- All Previous Topics	1	2
9	**Electrosurgical (Continue)**	• Design, block diagram, and components of electrosurgical, • Maintenance and troubleshooting of electrosurgical.	1	2
10	**Defibrillator**	• Introduction and medical back ground on the heart. • Abnormal signals of ECG, • Principles of operation for defibrillator, •	1	2
11	**Defibrillator (Continue)**	• Design, block diagram, and components of defibrillator, • Maintenance and troubleshooting of defibrillator.	1	2
12	**Report & Presentation**	• 3 to 4 students make a report and presentation about one medical treatment and therapy devices.	1	2
13	**Report & Presentation**	• 3 to 4 students make a report and presentation about one medical	1	2

IV. Course Contents:

A. Theoretical Aspect:

No.	Units/Topics List	Sub Topics List	Number of Weeks	Contact Hours
	(Continue)	treatment and therapy devices.		
14	**Infusion Pump**	• Introduction and medical back ground of infusion systems. • Principles of operation for infusion pump, • Design, block diagram, and components of infusion pump, • Maintenance and troubleshooting of infusion pump.	1	2
15	**Syringe Pump**	• Introduction and medical back ground, • Principle of operation for syringe pump, • Design, block diagram, and components of syringe pump, • Maintenance and troubleshooting of syringe pump.	1	2
16	**Final Theoretical Exam**	- All Topics	1	2
Number of Weeks /and Units Per Semester			**16**	**32**

B. Case Studies and Practical Aspect:

No.	Tasks/ Experiments	Number of Weeks	Contact Hours
1	- Introduction to medical treatment, and therapy instruments.	1	2
2	- Introduction to medical operation room and intensive care units.	1	2

B. Case Studies and Practical Aspect:			
No.	**Tasks/ Experiments**	**Number of Weeks**	**Contact Hours**
3	- Components of Ventilator equipment - Operation of Ventilator equipment	1	2
4	- Detection of errors, troubleshooting, repair, and maintenance of Ventilator equipment	1	2
5	- Components of Anesthesia Machine - Operation of Anesthesia Machine	1	2
6	- Detection of errors, troubleshooting, repair, and maintenance of Anesthesia Machine	1	2
7	- Midterm Practical Exam	1	2
8	- Components of Patient monitor - Operation of Patient monitor Detection of errors, troubleshooting, repair, and maintenance of Patient monitor	1	2
9	- Components of defibrillator - Operation of defibrillator - Detection of errors, troubleshooting, repair, and maintenance of defibrillator	1	2
10	- Components of Electrosurgical unit - Operation of Electrosurgical unit - Detection of errors, troubleshooting, repair, and maintenance of Electrosurgical unit	1	2
11	- Components of Infusion pump	1	2

B. Case Studies and Practical Aspect:			
No.	**Tasks/ Experiments**	**Number of Weeks**	**Contact Hours**
	- Operation of Infusion pump - Detection of errors, troubleshooting, repair, and maintenance of Infusion pump		
12	- Components of syringe pump - Operation of syringe pump - Detection of errors, troubleshooting, repair, and maintenance of syringe pump	1	2
13	- Practical Project	1	2
14	- Practical Project (Continue)	1	2
15	- Final Practical Exam	1	2
Number of Weeks /and Units Per Semester		**15**	**30**

V. Teaching Strategies of the Course:

- Interactive lectures & examples,
- Tutorials,
- Videos demonstrations,
- Presentation/seminar,
- Interactive class discussions,
- Case studies,
- Laboratory/Practical experiments based session,
- Computer laboratory-based sessions,
- Workshops practices,
- Directed self- study,

V. Teaching Strategies of the Course:

- Problem based learning,
- Team work (cooperative learning),
- Field visits/training,
- Mini/major project.

VI. Assessment Methods of the Course:

- Written tests (mid and final terms and quizzes),
- Short reports,
- Lab\Project report
- Practical lab performance assessment,
- Coursework activities assessment,
- Presentations.

VII. Assignments:

No	Assignments	Aligned CILOs(symbols)	Week Due	Mark
1				
2				
3				
4				
5				
Total				30

VIII. Schedule of Assessment Tasks for Students During the Semester:

No.	Assessment Method	Week Due	Mark	Proportion of Final Assessment
1	**Quiz 1**	6	5	3.33%
2	**Midterm Practical Exam**	7	20	13.33%
3	**Midterm Theoretical Exam**	8	10	6.67%
4	**Report, Presentation, and Project**	10, 11	20	13.33%
5	**Quiz 2**	12	5	3.33%
6	**Final Practical Exam**	15	30	20%
7	**Final Theoretical Exam**	16	60	40%
Total			**150**	**100%**

IX. Learning Resources:

- *Written in the following order:*
  - *Written in the following order: (Author - Year of publication – Title – Edition – Place of publication – Publisher).*

1- Required Textbook(s) (maximum two):

1- Ed. Joseph D. Bronzino, 2016, **The Biomedical Engineering Handbook**, Fourth Edition, CRC Press LLC.

2- Roger Narayan, 2019, **Wiley Encyclopedia of Biomedical Engineering**, Elsevier.

IX. Learning Resources:

2- Essential References:

1- James Moore, George Zouridakis, 2004, **Biomedical Technology and Devices Handbook**, CRC Press LLC.

2- Metin Akay, 2006, **Wiley Encyclopedia of Biomedical Engineering**, John Wiley & Sons, In.

3- John G. Webster, 2006, **Encyclopedia Of Medical Devices and Instrumentation**, Second Edition, John Wiley & Sons.

3- Electronic Materials and Web Sites etc.:

Websites:

1- Medical Devices & Sensors Journal, Wiley. Peer reviewed academic journal in the field of Medical Devices.

http://onlinelibrary.wiley.com/journal/2573802x

2- Journal of Medical Devices. Peer reviewed academic journal in the field of Medical Devices.

http://medigitalcollection.asme.org/

Journals:

3- IEEE Transactions on Biomedical Engineering: Peer reviewed academic journal in the field of Biomedical Engineering.

http://www.ieeexplore.ieee.org/xpl

4- Journal of Medical Devices. Peer reviewed academic journal in the field of Medical Devices

https://publons.com/journal/19039/journal-of-medical-devices

Other Web Sources:

5- Website: Franks Hospital Workshop

http://www.frankshospitalworkshop.com

X. Course Policies:

1	**Class Attendance:** A student should attend not less than 75 % of total hours of the subject; otherwise

	he/she will not be able to take the exam and will be considered as exam failure. If the student is absent due to illness, he/she should bring a proof statement from university Clinic. If the absent is more than 25% of a course total contact hours, student will be required to retake the entire course again.
2	**Tardy:** For late in attending the class, the student will be initially notified. If he repeated lateness in attending class, he/she will be considered as absent.
3	**Exam Attendance/Punctuality:** A student should attend the exam on time. He/she is permitted to attend an exam half one hour from exam beginning, after that he/she will not be permitted to take the exam and he/she will be considered as absent in exam
4	**Assignments & Projects:** In general one assignment is given to the students after each chapter; the student has to submit all the assignments for checking on time, mostly one week after given the assignment.
5	**Cheating:** For cheating in exam, a student will be considered as fail. In case the cheating is repeated three times during his/her study the student will be disengaged from the Faculty.
6	**Plagiarism:** Plagiarism is the attending of a student the exam of a course instead of another student. If the examination committee proofed a plagiarism of a student, he/she will be disengaged from the Faculty. The final disengagement of the student from the Faculty should be confirmed from the Student Council Affair of the university or according to the university roles.
7	**Other policies:** - Mobile phones are not allowed to use during a class lecture. It must be closed; **otherwise** the student will be asked to leave the lecture room. - Mobile phones are not allowed in class during the examination. - Lecture notes and assignments might be given directly to students using soft or

	hard copy.