



## Course Specification of Biomedical Equipment 3

### **Course Code (BE365)**

I. Course Identification and General Information:						
<b>1</b>	<b>Course Title:</b>	Biomedical Equipment 3				
<b>2</b>	<b>Course Code &amp; Number:</b>	BE365				
<b>3</b>	<b>Credit hours:</b>	C.H				TOTAL
		Th.	Seminar	Pr	Tr.	
		2	--	2	--	3
<b>4</b>	<b>Study level/ semester at which this course is offered:</b>	4 <sup>th</sup> Level / 2 <sup>nd</sup> Semester				
<b>5</b>	<b>Pre –requisite (if any):</b>	Biomedical Sensors and Measurements (BE224), Biomedical Equipment 2 (BE364)				
<b>6</b>	<b>Co –requisite (if any):</b>	None				
<b>7</b>	<b>Program (s) in which the course is offered:</b>	Biomedical Engineering Program				
<b>8</b>	<b>Language of teaching the course:</b>	English				
<b>9</b>	<b>Location of Teaching the Course:</b>	Faculty of Engineering				
<b>10</b>	<b>Prepared by:</b>	Dr. Mohammed Al-olofi				
<b>11</b>	<b>Reviewed by:</b>	Dr. Waleed Al-Talbi				
<b>12</b>	<b>Date of Approval:</b>					

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, sterilization department, intensive care units for neonatal and etc. . The students would be learned the	

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



skills for analyze, repair, maintenance, and troubleshooting as well as using maintenance, test, and calibration tools. The course includes: hemodialysis, infant incubators, infant incubators warmer, endoscopy, autoclave, washer machine and Steam Sterilization machines. The course focuses on practical activities related to operating, calibrations, troubleshooting, and maintenance of such equipment.

<b>III. Course Intended learning outcomes (CILOs) of the course</b> (maximum 8CILOs)		<b>Referenced PILOs</b> (Only write code number of referenced Program Intended learning outcomes)
<b>Knowledge and Understanding:</b> 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 devices which are used in different hospital departments.	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 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 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>B. Cognitive/ Intellectual Skills:</b> Upon successful completion of the undergraduate Biomedical Engineering Program, the graduates will be able to:		
b1	Design the medical devices which	B3 Design the biomedical systems or processes

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



	are used in different hospital departments with considerate environmental conditions, health and safety, manufacturability and sustainability.	within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability and sustainability.
b2	Categorize the medical 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.
<b>C. Professional and Practical Skills:</b> 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 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, troubleshooting, and maintenance the medical 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.
<b>D. Transferable Skills:</b> 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.

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



<b>(A) Alignment Course Intended Learning Outcomes of Knowledge and Understanding to Teaching Strategies and Assessment Strategies:</b>		
Course Intended Learning Outcomes	Teaching strategies	Assessment Strategies
<p><b>a1</b> Explain the basic concepts and principles for the medical devices which are used in different hospital departments.</p>	<ul style="list-style-type: none"> <li>• Interactive lectures &amp; examples,</li> <li>• Tutorials,</li> <li>• Videos demonstrations,</li> <li>• Presentation/seminar,</li> <li>• Interactive class discussions,</li> <li>• Case studies,</li> <li>• Laboratory/Practical experiments based session,</li> <li>• Computer laboratory-based sessions,</li> <li>• Workshops practices,</li> <li>• Directed self- study,</li> <li>• Problem based learning,</li> <li>• Team work (cooperative learning),</li> <li>• Field visits/training,</li> <li>• Mini/major project.</li> </ul>	<ul style="list-style-type: none"> <li>• Written tests (mid and final terms and quizzes),</li> <li>• Short reports,</li> <li>• Lab\Project report</li> <li>• Practical lab performance assessment,</li> <li>• Coursework activities assessment,</li> <li>• Presentations.</li> </ul>
<p><b>a2</b> Identify the operation principles, and design of medical devices.</p>	<ul style="list-style-type: none"> <li>• Interactive lectures &amp; examples,</li> <li>• Tutorials,</li> <li>• Videos demonstrations,</li> <li>• Presentation/seminar,</li> <li>• Interactive class discussions,</li> </ul>	<ul style="list-style-type: none"> <li>• Written tests (mid and final terms and quizzes),</li> <li>• Short reports,</li> <li>• Lab\Project report</li> <li>• Practical lab performance</li> </ul>

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



	<ul style="list-style-type: none"> <li>• Case studies,</li> <li>• Laboratory/Practical experiments based session,</li> <li>• Computer laboratory-based sessions,</li> <li>• Workshops practices,</li> <li>• Directed self- study,</li> <li>• Problem based learning,</li> <li>• Team work (cooperative learning),</li> <li>• Field visits/training,</li> <li>• Mini/major project.</li> </ul>	<ul style="list-style-type: none"> <li>assessment,</li> <li>• Coursework activities assessment,</li> <li>• Presentations.</li> </ul>
<p><b>a3</b> Describe the clinical applications of medical devices, their operational theories and their clinical environments.</p>	<ul style="list-style-type: none"> <li>• Interactive lectures &amp; examples,</li> <li>• Tutorials,</li> <li>• Videos demonstrations,</li> <li>• Presentation/seminar,</li> <li>• Interactive class discussions,</li> <li>• Case studies,</li> <li>• Laboratory/Practical experiments based session,</li> <li>• Computer laboratory-based sessions,</li> <li>• Workshops practices,</li> <li>• Directed self- study,</li> <li>• Problem based learning,</li> <li>• Team work (cooperative learning),</li> </ul>	<ul style="list-style-type: none"> <li>• Written tests (mid and final terms and quizzes),</li> <li>• Short reports,</li> <li>• Lab\Project report</li> <li>• Practical lab performance assessment,</li> <li>• Coursework activities assessment,</li> <li>• Presentations.</li> </ul>

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



	<ul style="list-style-type: none"> <li>• Field visits/training,</li> <li>• Mini/major project.</li> </ul>	
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<b>(B) Alignment Course Intended Learning Outcomes of Intellectual Skills to Teaching Strategies and Assessment Strategies:</b>		
Course Intended Learning Outcomes	Teaching strategies	Assessment Strategies
<p><b>b1</b> Design the medical devices which are used in different hospital departments with considerate environmental conditions, health and safety, manufacturability and sustainability.</p>	<ul style="list-style-type: none"> <li>• Interactive lectures &amp; examples,</li> <li>• Tutorials,</li> <li>• Videos demonstrations,</li> <li>• Presentation/seminar,</li> <li>• Interactive class discussions,</li> <li>• Case studies,</li> <li>• Laboratory/Practical experiments based session,</li> <li>• Computer laboratory-based sessions,</li> <li>• Workshops practices,</li> <li>• Directed self- study,</li> <li>• Problem based learning,</li> <li>• Team work (cooperative learning),</li> <li>• Field visits/training,</li> <li>• Mini/major project.</li> </ul>	<ul style="list-style-type: none"> <li>• Written tests (mid and final terms and quizzes),</li> <li>• Short reports,</li> <li>• Lab\Project report</li> <li>• Practical lab performance assessment,</li> <li>• Coursework activities assessment,</li> <li>• Presentations.</li> </ul>
<p><b>b2</b> Categorize the medical devices according to their specifications and features.</p>	<ul style="list-style-type: none"> <li>• Interactive lectures &amp; examples,</li> <li>• Tutorials,</li> <li>• Videos demonstrations,</li> </ul>	<ul style="list-style-type: none"> <li>• Written tests (mid and final terms and quizzes),</li> <li>• Short reports,</li> </ul>

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



	<ul style="list-style-type: none"> <li>• Presentation/seminar,</li> <li>• Interactive class discussions,</li> <li>• Case studies,</li> <li>• Laboratory/Practical experiments based session,</li> <li>• Computer laboratory-based sessions,</li> <li>• Workshops practices,</li> <li>• Directed self- study,</li> <li>• Problem based learning,</li> <li>• Team work (cooperative learning),</li> <li>• Field visits/training,</li> <li>• Mini/major project.</li> </ul>	<ul style="list-style-type: none"> <li>• Lab\Project report</li> <li>• Practical lab performance assessment,</li> <li>• Coursework activities assessment,</li> <li>• Presentations.</li> </ul>
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<b>(C) Alignment Course Intended Learning Outcomes of Professional and Practical Skills to Teaching Strategies and Assessment Strategies:</b>		
Course Intended Learning Outcomes	Teaching strategies	Assessment Strategies
<p><b>c1</b> Use mathematical, simulation models, and IT software packages to medical devices effectively.</p>	<ul style="list-style-type: none"> <li>• Interactive lectures &amp; examples,</li> <li>• Tutorials,</li> <li>• Videos demonstrations,</li> <li>• Presentation/seminar,</li> <li>• Interactive class discussions,</li> <li>• Case studies,</li> <li>• Laboratory/Practical experiments based session,</li> </ul>	<ul style="list-style-type: none"> <li>• Written tests (mid and final terms and quizzes),</li> <li>• Short reports,</li> <li>• Lab\Project report</li> <li>• Practical lab performance assessment,</li> <li>• Coursework activities assessment,</li> <li>• sPresentations.</li> </ul>

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



	<ul style="list-style-type: none"> <li>• Computer laboratory-based sessions,</li> <li>• Workshops practices,</li> <li>• Directed self- study,</li> <li>• Problem based learning,</li> <li>• Team work (cooperative learning),</li> <li>• Field visits/training,</li> <li>• Mini/major project.</li> </ul>	
<p><b>c2</b> Construct, operate, troubleshooting, and maintenance the medical devices by using rules and regulations of industrial safety.</p>	<ul style="list-style-type: none"> <li>• Interactive lectures &amp; examples,</li> <li>• Tutorials,</li> <li>• Videos demonstrations,</li> <li>• Presentation/seminar,</li> <li>• Interactive class discussions,</li> <li>• Case studies,</li> <li>• Laboratory/Practical experiments based session,</li> <li>• Computer laboratory-based sessions,</li> <li>• Workshops practices,</li> <li>• Directed self- study,</li> <li>• Problem based learning,</li> <li>• Team work (cooperative learning),</li> <li>• Field visits/training,</li> <li>• Mini/major project.</li> </ul>	<ul style="list-style-type: none"> <li>• Written tests (mid and final terms and quizzes),</li> <li>• Short reports,</li> <li>• Lab\Project report</li> <li>• Practical lab performance assessment,</li> <li>• Coursework activities assessment,</li> <li>• Presentations.</li> </ul>



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



<b>(D) Alignment Course Intended Learning Outcomes of Transferable Skills to Teaching Strategies and Assessment Strategies:</b>		
Course Intended Learning Outcomes	Teaching strategies	Assessment Strategies
<p><b>d1</b> Function effectively in different work environments as an individual, and as a member or leader in multi-disciplinary teams.</p>	<ul style="list-style-type: none"> <li>• Interactive lectures &amp; examples,</li> <li>• Tutorials,</li> <li>• Videos demonstrations,</li> <li>• Presentation/seminar,</li> <li>• Interactive class discussions,</li> <li>• Case studies,</li> <li>• Laboratory/Practical experiments based session,</li> <li>• Computer laboratory-based sessions,</li> <li>• Workshops practices,</li> <li>• Directed self- study,</li> <li>• Problem based learning,</li> <li>• Team work (cooperative learning),</li> <li>• Field visits/training,</li> <li>• Mini/major project.</li> </ul>	<ul style="list-style-type: none"> <li>• Written tests (mid and final terms and quizzes),</li> <li>• Short reports,</li> <li>• Lab\Project report</li> <li>• Practical lab performance assessment,</li> <li>• Coursework activities assessment,</li> <li>• Presentations.</li> </ul>

<b>IV. Course Content:</b>					
<b>A – Theoretical Aspect:</b>					
Order	Units/Topics List	Learning Outcomes	Sub Topics List	Number of Weeks	contact hours
1	<b>Introduction of sterilization</b>	a1	• Introduction of sterilization department,	1	2

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



	<b>department.</b>		<ul style="list-style-type: none"> <li>• Design of sterilization department.</li> </ul>		
<b>2</b>	<b>Autoclave</b>	a1, a2, a3, b1,b2, c1, c2	<ul style="list-style-type: none"> <li>• Introduction and medical back ground,</li> <li>• Types of autoclave,</li> <li>• Principles of operation for autoclave machine,</li> <li>• Design, block diagram, and components of autoclave machine,</li> <li>• Maintenance and troubleshooting of autoclave machine</li> </ul>	1	2
<b>3</b>	<b>Washer Machine</b>	a1, a2, a3, b1,b2, c1, c2	<ul style="list-style-type: none"> <li>• Introduction and medical back ground,</li> <li>• Types of washer machine,</li> <li>• Principles of operation for washer machine,</li> <li>• Design, block diagram, and components of washer machine,</li> <li>• Maintenance and troubleshooting of washer machine</li> </ul>	1	2
<b>4</b>	<b>Sterilization Machine</b>	a1, a2, a3, b1,b2, c1, c2	<ul style="list-style-type: none"> <li>• Introduction and medical back ground,</li> <li>• Types of sterilization,</li> <li>• Principles of operation for sterilization machine,</li> </ul>	1	2
<b>5</b>	<b>Sterilization Machine (Continue)</b>	a1, a2, a3, b1,b2, c1, c2	<ul style="list-style-type: none"> <li>• Design, block diagram, and components of sterilization machine,</li> <li>• Maintenance and troubleshooting of sterilization machine</li> </ul>	1	2
<b>6</b>	<b>Infant Incubator</b>	a1, a2, a3, b1,b2, c1, c2	<ul style="list-style-type: none"> <li>• Introduction and medical background,</li> <li>• Types of design for infant incubator,</li> </ul>	1	2

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



			<ul style="list-style-type: none"> <li>Principles of operation of infant incubator,</li> </ul>		
7	<b>Infant Incubator (Continue)</b>	a1, a2, a3, b1,b2, c1, c2	<ul style="list-style-type: none"> <li>Design, block diagram, and components of infant incubator,</li> <li>Maintenance and troubleshooting of infant incubator.</li> </ul>	1	2
8	<b>Mid-Term Theoretical Exam</b>	a1, a2, a3, b1,b2, c1, c2	- All Previous Topics	1	2
9	<b>Infant warmer</b>	a1, a2, a3, b1,b2, c1, c2	<ul style="list-style-type: none"> <li>Introduction and medical background,</li> <li>Types of design for infant warmer,</li> <li>Principles of operation of infant warmer,</li> <li>Design, block diagram, and components of infant warmer,</li> <li>Maintenance and troubleshooting of infant warmer.</li> </ul>	1	2
10	<b>Hemodialysis Machine</b>	a1, a2, a3, b1,b2, c1, c2	<ul style="list-style-type: none"> <li>Introduction and medical background of kidney,</li> <li>History of artificial kidney,</li> <li>Principles of operation for hemodialysis machine,</li> </ul>	1	2
11	<b>Hemodialysis Machine (Continue)</b>	a1, a2, a3, b1,b2, c1, c2	<ul style="list-style-type: none"> <li>Design, block diagram, and components of hemodialysis machine,</li> <li>Maintenance and troubleshooting of hemodialysis machine</li> </ul>	1	2
12	<b>Report &amp; Presentation</b>	a1, a2, a3, b1,b2, c1, c2, d1	<ul style="list-style-type: none"> <li>3 to 4 students make a report and presentation about one medical devices.</li> </ul>	1	2
13	<b>Report &amp; Presentation (Continue)</b>	a1, a2, a3, b1,b2, c1, c2, d1	<ul style="list-style-type: none"> <li>3 to 4 students make a report and presentation about one medical devices.</li> </ul>	1	2

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



14	<b>Endoscopy Machine</b>	a1, a2, a3, b1,b2, c1, c2	<ul style="list-style-type: none"> <li>• Introduction and medical back ground of endoscopy systems.</li> <li>• Principles of operation for endoscopy,</li> </ul>	1	2
15	<b>Endoscopy Machine (Continue)</b>	a1, a2, a3, b1,b2, c1, c2	<ul style="list-style-type: none"> <li>• Design, block diagram, and components of endoscopy,</li> <li>• Maintenance and troubleshooting of endoscopy.</li> </ul>	1	2
16	<b>Final Theoretical Exam</b>	a1, a2, a3, b1,b2, c1, c2	- All Topics	1	2
<b>Number of Weeks /and Units Per Semester</b>				<b>16</b>	<b>32</b>

<b>B - Practical Aspect: (if any)</b>				
Order	Tasks/ Experiments	Number of Weeks	contact hours	Learning Outcomes
1	- Introduction to sterilization department .	1	2	a1, a2, a3
2	- Components of autoclave equipment - Operation of autoclave equipment - Detection of errors, troubleshooting, repair, and maintenance of autoclave equipment	1	2	a1, a2, a3, b1,b2, c1, c2
3	- Components of washer machine - Operation of washer machine - Detection of errors, troubleshooting, repair, and maintenance of washer machine	1	2	a1, a2, a3, b1,b2, c1, c2
4	- Components of steam sterilization machine	1	2	a1, a2, a3, b1,b2, c1, c2

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



	- Operation of steam sterilization machine			
<b>5</b>	- Detection of errors, troubleshooting, repair, and maintenance of steam sterilization machine	1	2	a1, a2, a3, b1,b2, c1, c2
<b>6</b>	- Components of infant incubator - Operation of infant incubator	1	2	a1, a2, a3, b1,b2, c1, c2
<b>7</b>	- <b>Midterm Practical Exam</b>	<b>1</b>	<b>2</b>	<b>a1, a2, a3, b1,b2, c1, c2</b>
<b>8</b>	- Detection of errors, troubleshooting, repair, and maintenance of infant incubator	1	2	a1, a2, a3, b1,b2, c1, c2
<b>9</b>	- Components of infant warmer - Operation of infant warmer - Detection of errors, troubleshooting, repair, and maintenance of infant warmer	1	2	a1, a2, a3, b1,b2, c1, c2
<b>10</b>	- Components of hemodialysis machine - Operation of hemodialysis machine - Detection of errors, troubleshooting, repair, and maintenance of hemodialysis machine	1	2	a1, a2, a3, b1,b2, c1, c2
<b>11</b>	- Components of endoscopy - Operation of endoscopy	1	2	a1, a2, a3, b1,b2, c1, c2
<b>12</b>	- Detection of errors, troubleshooting, repair, and maintenance of endoscopy	1	2	a1, a2, a3, b1,b2, c1, c2

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



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	- <b>Final Practical Exam</b>	1	2	<b>a1, a2, a3, b1,b2, c1, c2</b>
<b>Number of Weeks /and Units Per Semester</b>			<b>15</b>	<b>30</b>

**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),
- 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,



**VI. Assessment Methods of the Course:**

- Presentations.

**VII. Assignments:**

No	Assignments	Aligned CILOs(symbols)	Week Due	Mark
1				
2				
3				
4				
5				
<b>Total</b>				

**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

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



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:	
<ul style="list-style-type: none"> <li>Written in the following order: ( Author - Year of publication – Title – Edition – Place of publication – Publisher).</li> </ul>	
1- Required Textbook(s) ( maximum two ).	
	1- Ed. Joseph D. Bronzino, 2016, <b>The Biomedical Engineering Handbook</b> , Fourth Edition, CRC Press LLC. 2- Roger Narayan, 2019, <b>Wiley Encyclopedia of Biomedical Engineering</b> , Elsevier.
2- Essential References.	
	1- James Moore, George Zouridakis, 2004, <b>Biomedical Technology and Devices Handbook</b> , CRC Press LLC. 2- Metin Akay, 2006, <b>Wiley Encyclopedia of Biomedical Engineering</b> , John Wiley & Sons, In. 3- John G. Webster, 2006, <b>Encyclopedia Of Medical Devices and Instrumentation</b> , Second Edition, John Wiley & Sons.
3- Electronic Materials and Web Sites etc.	
	<p><b>Websites:</b></p> 1- Medical Devices & Sensors Journal, Wiley. Peer reviewed academic journal in the field of Medical Devices. <a href="http://onlinelibrary.wiley.com/journal/2573802x">http://onlinelibrary.wiley.com/journal/2573802x</a> 2- Journal of Medical Devices. Peer reviewed academic journal in the field of Medical Devices. <a href="http://medigitalcollection.asme.org/">http://medigitalcollection.asme.org/</a> <p><b>Journals:</b></p> 3- IEEE Transactions on Biomedical Engineering: Peer reviewed academic journal in the field of Biomedical Engineering.



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



	<p><a href="http://www.ieeexplore.ieee.org/xpl">http://www.ieeexplore.ieee.org/xpl</a></p> <p>4- Journal of Medical Devices. Peer reviewed academic journal in the field of Medical Devices</p> <p><a href="https://publons.com/journal/19039/journal-of-medical-devices">https://publons.com/journal/19039/journal-of-medical-devices</a></p> <p><b>Other Web Sources:</b></p> <p>5- Website: Franks Hospital Workshop</p> <p><a href="http://www.frankshospitalworkshop.com">http://www.frankshospitalworkshop.com</a></p>
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<b>X. Course Policies:</b>	
<b>1</b>	<p><b>Class Attendance:</b></p> <p>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.</p>
<b>2</b>	<p><b>Tardy:</b></p> <p>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.</p>
<b>3</b>	<p><b>Exam Attendance/Punctuality:</b></p> <p>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</p>
<b>4</b>	<p><b>Assignments &amp; Projects:</b></p> <p>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.</p>
<b>5</b>	<p><b>Cheating:</b></p> <p>For cheating in exam, a student will be considered as fail. In case the cheating is repeated three</p>

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



	times during his/her study the student will be disengaged from the Faculty.
<b>6</b>	<p><b>Plagiarism:</b></p> <p>Plagiarism is the attending of a student the exam of a course instead of another student.</p> <p>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.</p>
<b>7</b>	<p><b>Other policies:</b></p> <ul style="list-style-type: none"> <li>- Mobile phones are not allowed to use during a class lecture. It must be closed; <b>otherwise</b> the student will be asked to leave the lecture room.</li> <li>- Mobile phones are not allowed in class during the examination.</li> <li>- Lecture notes and assignments might be given directly to students using soft or hard copy.</li> </ul>



**Template for Course Plan (Syllabus)**

**Biomedical Equipment 3-(BE365)**

<b>I. Course Identification and General Information:</b>					
1	<b>Course Title:</b>	Biomedical Equipment 3			
2	<b>Course Code &amp; Number:</b>	BE365			
3	<b>Credit Hours:</b>	<b>Credit Hours</b>	<b>Theory Hours</b>		<b>Lab. Hours</b>
			<b>Lecture</b>	<b>Exercise</b>	
		3	2	--	2
4	<b>Study Level/ Semester at which this Course is offered:</b>	4 <sup>th</sup> Level / 2 <sup>nd</sup> Semester			
5	<b>Pre –Requisite (if any):</b>	Biomedical Sensors and Measurements (BE224), Biomedical Equipment 2 (BE364)			
6	<b>Co –Requisite (if any):</b>	None			
7	<b>Program (s) in which the Course is Offered:</b>	Bachelor of Biomedical Engineering			
8	<b>Language of Teaching the Course:</b>	English			
9	<b>Location of Teaching the Course:</b>	Faculty of Engineering			
10	<b>Prepared by:</b>	Dr. Mohammed Al-olofi			
11	<b>Reviewed by:</b>	Dr. Waleed Al-Talbi			
12	<b>Date of Approval:</b>				

**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, sterilization department, intensive care units for neonatal and etc. . The students would be learned the

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



skills for analyze, repair, maintenance, and troubleshooting as well as using maintenance, test, and calibration tools. The course includes: hemodialysis, infant incubators, infant incubators warmer, endoscopy, autoclave, washer machine and Steam Sterilization machines. 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 devices which are used in different hospital departments.
a2	Identify the operation principles, and design of medical devices.
a3	Describe the clinical applications of medical 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 devices which are used in different hospital departments with considerate environmental conditions, health and safety, manufacturability and sustainability.
b2	Categorize the medical 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 devices effectively.
c2	Construct, operate, troubleshooting, and maintenance the medical 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.
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**University of Sana'a**  
**Faculty of Engineering**  
**Department: Biomedical Engineering**  
**Title of the Program: Biomedical Engineering**



<b>IV. Course Contents:</b>				
<b>A. Theoretical Aspect:</b>				
<b>No.</b>	<b>Units/Topics List</b>	<b>Sub Topics List</b>	<b>Number of Weeks</b>	<b>Contact Hours</b>
1	<b>Introduction of sterilization department.</b>	<ul style="list-style-type: none"> <li>• Introduction of sterilization department,</li> <li>• Design of sterilization department.</li> </ul>	1	2
2	<b>Autoclave</b>	<ul style="list-style-type: none"> <li>• Introduction and medical back ground,</li> <li>• Types of autoclave,</li> <li>• Principles of operation for autoclave machine,</li> <li>• Design, block diagram, and components of autoclave machine,</li> <li>• Maintenance and troubleshooting of autoclave machine</li> </ul>	1	2
3	<b>Washer Machine</b>	<ul style="list-style-type: none"> <li>• Introduction and medical back ground,</li> <li>• Types of washer machine,</li> <li>• Principles of operation for washer machine,</li> <li>• Design, block diagram, and components of washer machine,</li> <li>• Maintenance and troubleshooting of washer machine</li> </ul>	1	2
4	<b>Sterilization Machine</b>	<ul style="list-style-type: none"> <li>• Introduction and medical back ground,</li> <li>• Types of sterilization,</li> <li>• Principles of operation for sterilization machine,</li> </ul>	1	2
5	<b>Sterilization Machine (Continue)</b>	<ul style="list-style-type: none"> <li>• Design, block diagram, and components of sterilization machine,</li> <li>• Maintenance and troubleshooting of sterilization machine</li> </ul>	1	2

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



<b>IV. Course Contents:</b>				
<b>A. Theoretical Aspect:</b>				
<b>No.</b>	<b>Units/Topics List</b>	<b>Sub Topics List</b>	<b>Number of Weeks</b>	<b>Contact Hours</b>
6	<b>Infant Incubator</b>	<ul style="list-style-type: none"> <li>• Introduction and medical background,</li> <li>• Types of design for infant incubator,</li> <li>• Principles of operation of infant incubator,</li> </ul>	1	2
7	<b>Infant Incubator (Continue)</b>	<ul style="list-style-type: none"> <li>• Design, block diagram, and components of infant incubator,</li> <li>• Maintenance and troubleshooting of infant incubator.</li> </ul>	1	2
8	<b>Mid-Term Theoretical Exam</b>	- All Previous Topics	1	2
9	<b>Infant warmer</b>	<ul style="list-style-type: none"> <li>• Introduction and medical background,</li> <li>• Types of design for infant warmer,</li> <li>• Principles of operation of infant warmer,</li> <li>• Design, block diagram, and components of infant warmer,</li> <li>• Maintenance and troubleshooting of infant warmer.</li> </ul>	1	2
10	<b>Hemodialysis Machine</b>	<ul style="list-style-type: none"> <li>• Introduction and medical background of kidney,</li> <li>• History of artificial kidney,</li> <li>• Principles of operation for hemodialysis machine,</li> </ul>	1	2
11	<b>Hemodialysis Machine (Continue)</b>	<ul style="list-style-type: none"> <li>• Design, block diagram, and components of hemodialysis machine,</li> <li>• Maintenance and troubleshooting of hemodialysis machine</li> </ul>	1	2

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



<b>IV. Course Contents:</b>				
<b>A. Theoretical Aspect:</b>				
No.	Units/Topics List	Sub Topics List	Number of Weeks	Contact Hours
12	<b>Report &amp; Presentation</b>	<ul style="list-style-type: none"> <li>3 to 4 students make a report and presentation about one medical devices.</li> </ul>	1	2
13	<b>Report &amp; Presentation (Continue)</b>	<ul style="list-style-type: none"> <li>3 to 4 students make a report and presentation about one medical devices.</li> </ul>	1	2
14	<b>Endoscopy Machine</b>	<ul style="list-style-type: none"> <li>Introduction and medical back ground of endoscopy systems.</li> <li>Principles of operation for endoscopy,</li> <li></li> </ul>	1	2
15	<b>Endoscopy Machine (Continue)</b>	<ul style="list-style-type: none"> <li>Design, block diagram, and components endoscopy,</li> <li>Maintenance and troubleshooting of endoscopy.</li> </ul>	1	2
16	<b>Final Theoretical Exam</b>	- All Topics	1	2
<b>Number of Weeks /and Units Per Semester</b>			<b>16</b>	<b>32</b>

<b>B. Case Studies and Practical Aspect:</b>			
No.	Tasks/ Experiments	Number of Weeks	Contact Hours
1	- Introduction to sterilization department .	1	2
2	<ul style="list-style-type: none"> <li>Components of autoclave equipment</li> <li>Operation of autoclave equipment</li> <li>Detection of errors, troubleshooting, repair, and maintenance of autoclave equipment</li> </ul>	1	2

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



<b>B. Case Studies and Practical Aspect:</b>			
<b>No.</b>	<b>Tasks/ Experiments</b>	<b>Number of Weeks</b>	<b>Contact Hours</b>
<b>3</b>	<ul style="list-style-type: none"> <li>- Components of washer machine</li> <li>- Operation of washer machine</li> <li>- Detection of errors, troubleshooting, repair, and maintenance of washer machine</li> </ul>	1	2
<b>4</b>	<ul style="list-style-type: none"> <li>- Components of steam sterilization machine</li> <li>- Operation of steam sterilization machine</li> </ul>	1	2
<b>5</b>	<ul style="list-style-type: none"> <li>- Detection of errors, troubleshooting, repair, and maintenance of steam sterilization machine</li> </ul>	1	2
<b>6</b>	<ul style="list-style-type: none"> <li>- Components of infant incubator</li> <li>- Operation of infant incubator</li> </ul>	1	2
<b>7</b>	<ul style="list-style-type: none"> <li>- Midterm Practical Exam</li> </ul>	1	2
<b>8</b>	<ul style="list-style-type: none"> <li>- Detection of errors, troubleshooting, repair, and maintenance of infant incubator</li> </ul>	1	2
<b>9</b>	<ul style="list-style-type: none"> <li>- Components of infant warmer</li> <li>- Operation of infant warmer</li> <li>- Detection of errors, troubleshooting, repair, and maintenance of infant warmer</li> </ul>	1	2
<b>10</b>	<ul style="list-style-type: none"> <li>- Components of hemodialysis machine</li> <li>- Operation of hemodialysis machine</li> <li>- Detection of errors, troubleshooting, repair, and maintenance of hemodialysis machine</li> </ul>	1	2
<b>11</b>	<ul style="list-style-type: none"> <li>- Components of endoscopy</li> </ul>	1	2



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



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

<b>V. Teaching Strategies of the Course:</b>
<ul style="list-style-type: none"> <li>• Interactive lectures &amp; examples,</li> <li>• Tutorials,</li> <li>• Videos demonstrations,</li> <li>• Presentation/seminar,</li> <li>• Interactive class discussions,</li> <li>• Case studies,</li> <li>• Laboratory/Practical experiments based session,</li> <li>• Computer laboratory-based sessions,</li> <li>• Workshops practices,</li> <li>• Directed self- study,</li> <li>• Problem based learning,</li> <li>• Team work (cooperative learning),</li> <li>• Field visits/training,</li> <li>• Mini/major project.</li> </ul>



**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				
<b>Total</b>				

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

No.	Assessment Method	Week Due	Mark	Proportion of Final Assessment
1	<b>Quiz 1</b>	6	5	3.33%
2	<b>Midterm Practical Exam</b>	7	20	13.33%
3	<b>Midterm Theoretical Exam</b>	8	10	6.67%



<b>VIII. Schedule of Assessment Tasks for Students During the Semester:</b>				
No.	Assessment Method	Week Due	Mark	Proportion of Final Assessment
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%
<b>Total</b>			<b>150</b>	<b>100%</b>

<b>IX. Learning Resources:</b>
<ul style="list-style-type: none"> <li>Written in the following order:                             <ul style="list-style-type: none"> <li>Written in the following order: ( Author - Year of publication – Title – Edition – Place of publication – Publisher).</li> </ul> </li> </ul>
<b>1- Required Textbook(s) (maximum two):</b>
1- Ed. Joseph D. Bronzino, 2016, <b>The Biomedical Engineering Handbook</b> , Fourth Edition, CRC Press LLC. 2- Roger Narayan, 2019, <b>Wiley Encyclopedia of Biomedical Engineering</b> , Elsevier.
<b>2- Essential References:</b>
1- James Moore, George Zouridakis, 2004, <b>Biomedical Technology and Devices Handbook</b> , CRC Press LLC. 2- Metin Akay, 2006, <b>Wiley Encyclopedia of Biomedical Engineering</b> , John Wiley & Sons, In. 3- John G. Webster, 2006, <b>Encyclopedia Of Medical Devices and Instrumentation</b> , Second Edition, John Wiley & Sons.
<b>3- Electronic Materials and Web Sites etc.:</b>
<b>Websites:</b>
1- Medical Devices & Sensors Journal, Wiley. Peer reviewed academic journal in the field of Medical Devices.



**IX. Learning Resources:**

<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:**

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



	considered as absent in exam
<b>4</b>	<p><b>Assignments &amp; Projects:</b></p> <p>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.</p>
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