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

Course Specification of Safety in Biomedical Engineering

Course Code (BE372)

I. Course Identification and General Information:						
1	**Course Title:**	Safety in Biomedical Engineering				
2	**Course Code & Number:**	BE372				
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 / 2nd Semester				
5	**Pre –requisite (if any):**	Biomedical Sensors and Measurements (BE224), Biomedical Equipment I (BE263), Biomedical Equipment II (BE364).				
6	**Co –requisite (if any):**	Hospital Systems: Design & Management (BE374), Biomedical Equipment III (BE365), Biomedical Systems Design (BE367)				
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. Waleed Al-talabi				
11	**Reviewed by:**	Dr. Mohammed Al-olofi				
12	**Date of Approval:**					

II. Course Description:

The Safety in Biomedical Engineering course introduces students to the requirements methods and practices to identify and manage applicable safety in a work environment. Students will learn how to achieve optimum safety in risky environments due to electrical wiring and other unsafe equipment and/or due to health conditions in microbial, radiation, or polluted ambience. The course topics include: basic definitions, biomedical hazard recognition, electrical & patient safety, fire safety, radiation safety, laser and ultraviolet (UV) radiation safety, laboratory safety, infection control and prevention, biomedical hazard control, biomedical waste management, and regulatory requirement for healthcare and medical device.

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 key concepts, types and measures related to biomedical hazards and safety in healthcare systems.	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 workplace hazards, their impact and the guidelines of precautionary and safety measures in healthcare.	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	Analyze biomedical hazards infections, wastes, and accidents and suggest	B1 Apply engineering principles; basic of life-science; mathematical theories; and modern tools professionally in modelling, analyzing,

	methods and equipment to respond to an incident, reduce and control risks in the workplace.	designing, and constructing physical digital systems; devices and/or processes relevant to Biomedical Engineering fields.
b2	Design efficient safety facility and control measures and waste disposal procedures in hospitals and healthcare facilities.	B3 Design the biomedical systems or processes within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability and sustainability.
C. Professional and Practical Skills: Upon successful completion of the undergraduate Biomedical Engineering Program, the graduates will be able to:		
c1	Conduct appropriate experimentation related to electrical and fire hazards to assess risks using science-based approaches.	C1 Apply integrally knowledge of mathematics, life science, IT, design, business context and engineering practice to solve problems and to design systems/processes relevant to Biomedical Engineering.
c2	Integrate the law and regulatory requirements for healthcare and medical devices to maximize the safety and health conditions in the workplace.	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	Work collaboratively as an effective member or leader of diverse teams in risky environments and within constraints.	D1 Lead and motivate individuals, show capability to work in stressful environments and within constraints, collaborate effectively within multidisciplinary team.
d2	Acquire skills to effectively manage issues related to biomedical hazards and safety.	D2 Acquire entrepreneurial skills and effectively manage tasks, time, processes and resources.

(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 key concepts, types and measures related to biomedical hazards and safety in healthcare systems.	• Interactive lectures & examples, • Interactive class discussions.	• Written tests (mid and final terms and quizzes), • Home works and assignments.
a2 Identify workplace hazards, their impact and the guidelines of precautionary and safety measures in healthcare.	• Interactive lectures & examples, • Presentation/seminar, • Interactive class discussions, • Directed self- study.	• Written tests (mid and final terms and quizzes), • Home works and assignments, • Presentations.

(B) Alignment Course Intended Learning Outcomes of Intellectual Skills to Teaching Strategies and Assessment Strategies:		
Course Intended Learning Outcomes	Teaching strategies	Assessment Strategies
b1 Analyze biomedical hazards infections, wastes, and accidents and suggest methods and equipment to respond to an incident, reduce and control risks in the workplace.	• Interactive lectures & examples, • Tutorials, • Presentation/seminar, • Interactive class discussions, • Directed self- study, • Team work (cooperative learning).	• Written tests (mid and final terms and quizzes), • Home works and assignments, • Presentations.
b2 Design efficient safety facility and control measures	• Interactive lectures & examples,	• Written tests (mid and final terms and

and waste disposal procedures in hospitals and healthcare facilities.	• Tutorials, • Presentation/seminar, • Interactive class discussions, • Directed self- study, • Team work (cooperative learning), • Field visits/training.	quizzes), • Short reports, • Home works and assignments, • 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 Conduct appropriate experimentation related to electrical and fire hazards to assess risks using science-based approaches.	• Interactive lectures & examples, • Tutorials, • Presentation/seminar, • Interactive class discussions, • Laboratory/Practical experiments based session, • Directed self- study, • 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, • Home works and assignments, • Presentations.
c2 Integrate the law and regulatory requirements for healthcare and medical devices to maximize the safety and health conditions in the workplace.	• Interactive lectures & examples, • Presentation/seminar, • Interactive class discussions,	• Written tests (mid and final terms and quizzes), • Short reports, • Lab\Project report

	• Laboratory/Practical experiments based session, • Directed self- study, • Team work (cooperative learning), • Field visits/training, • Mini/major project.	• Practical lab performance assessment, • Home works and assignments, • 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 Work collaboratively as an effective member or leader of diverse teams in risky environments and within constraints.	• Interactive lectures & examples, • Presentation/seminar, • Interactive class discussions, • Directed self- study, • Problem based learning, • Team work (cooperative learning), • Field visits/training, • Mini/major project.	• Written tests (mid and final terms and quizzes), • Home works and assignments, • Presentations.
d2 Acquire skills to effectively manage issues related to biomedical hazards and safety.	• Interactive lectures & examples, • Directed self- study, • Team work (cooperative learning), • Field visits/training.	• Written tests (mid and final terms and quizzes), • Short reports, • Home works and assignments, • Presentations.

I. Course Content:

A – Theoretical Aspect:

Order	Units/Topics List	Learning Outcomes	Sub Topics List	Number of Weeks	contact hours
1	**Introduction**	a1, a2	– Introduction to the course. – Course outlines. – Project description. – Overview on biomedical hazards and safety (Definitions - Types).	1	2
2	**Biomedical Hazards**	a1, a2	– Common hazards in the workplace, their effects and symptoms and manage them. – **Electrical Hazards** (Sources, Effect, and Protection). – **Mechanical Hazards** (Sources, Effect, and Protection). – Mechanical/Electrical/Hydraulic/Pneumatic actuation. – **Biological Hazard** (Sources, Effect, and Protection). – **Chemical Hazards** (Sources, Effect, and Protection). – **Temperature Hazards** (Sources, Effect, and Protection). – **Radiation Hazards** (Sources, Effect, and Protection). – **Psychosocial Hazards** (Sources, Effect, and Protection). – Psychosocial Annoyance.	2	4
3	**Electrical &Patient**	a2,	– Physiological effects of electricity. – Important susceptibility parameters.	2	4

	Safety		– Distribution of electric power. – Sources of shocks, macro & micro shocks. – Basic approaches to shock protection. – Leakage Currents (Hazards, monitoring and interrupting the operation). – Protection: power distribution. – Protection: equipment design. – Electrical safety analyser. – Testing the electric system. – Tests of electric appliances. – Testing of biomedical equipment. – Electrical-safety codes and standards for medical equipment.		
4	**Fire Safety**	a2, b1	– Elements of fire, causes of fire. – Action to be taken in case of fire in hospital. – Fire safety management.	1	2
5	**Radiation Safety**	a2, b1	– Design and description of nuclear medicine department. – Radiation protection in nuclear industry. – Guidelines for radiation protection. – Molecular medicine and radiation safety program. – Procedures for safe operation of radiation equipment. – Radiation protection in external beam radiotherapy. – Radiation protection in brachytherapy. – Radioactive wastes.	1	2
6	**Mid-Term**	a1, a2, b1	All previous topics	1	2

	Theoretical Exam				
7	**Laser and Ultraviolet (UV) Radiation Safety**	a1, a2, b1	– Classification of UV radiation. – Sources of UV. – Biological effects of UV. – Hazards associated with UV radiation. – UV control measures. – Safety management of UV. – Classifications of LASER and its radiation hazards. – Control measures. – Emergencies and incident procedures.	1	2
8	**Laboratory Safety**	a1, a2, b1	– Introductory information. – Understanding the hazards of chemicals. – Working safety with hazardous materials. – Emergency response.	1	2
9	**Infection Control and Prevention**	a1, a2, b1	– Healthcare immunizations. – Centres for disease control and prevention. – Disinfectants, sterilant, and antiseptics. – OSHA blood borne pathogens standard, tuberculosis, healthcare opportunistic infections.	1	2
10	**Biomedical Hazard Control**	a1, a2, b1	– Introduction. – Hazard control management. – Hazard control responsibilities. – Addressing behaviours. – Hazard control practice. – Hazard analysis. – Hazard control and correction. – Personal protective equipment.	2	4

			– Hazard control committees. – Hazard control evaluation. – System safety. – Understanding accidents: (Accident causation theories, human factors, accident deviation models, reporting, investigations, analysis, prevention, workers' compensation, orientation, education and training).		
11	**Biomedical Waste Management**	a1, a2, b1, c2	– Types of biomedical wastes. – Major and minor sources of waste. – Categories and classification of biomedical waste. – Hazard of biomedical waste. – Need for disposal of biomedical waste. – Waste minimization. – Waste segregation and labelling. – Waste handling, collection, storage and transportation. – Treatment and disposal.	1	2
12	**Regulatory Requirement for Healthcare and Medical Device**	a2, b1, c2	– Systems approach to medical device safety. – Medical device standards, regulations, and the law. – Need for standards and their development.	1	2
13	**Final Theoretical Exam**	a1, a2, b1, c2	All topics.	1	2
Number of Weeks /and Units Per Semester				**16**	**32**

B - Practical Aspect:

Order	Tasks/ Experiments	Number of Weeks	contact hours	Learning Outcomes
1	Select a specific biomedical hazard from the list that provided in the second lecture, then analyze the hazard and develop control schemes to eliminate or mitigate it.	2	4	b1, c1, d2, d1
2	Electrical safety fundamentals experiments.	1	2	b1, c1, d2, d1
3	Electrical safety analyzer.	1	2	b1, c1, d2, d1
4	Leakage currents test.	1	2	c1, d2, d1
5	Basic methods to protection against shock.	1	2	b1, c1, b2, d2, d1
6	Power and electrical distribution protection (Circuit Breakers)	1	2	b1, c1, b2, d2, d1
7	Power and electrical distribution protection (Earthing)	1	2	b1, c1, b2, d2, d1
8	**Mid-Term Practical Exam**	1	2	b1, c1, b2, d2, d1
9	Electrical system testing.	1	2	b1, c1, d2, d1
10	Fire system safety and alarms.	1	2	b1, c1, b2, d2, d1

11	Some LASER applications.	1	2	b1, c1, d2, d1
12	**Project/ Presentation**	1	2	b1, c1, b2, d2, d1
13	**Final Practical Exam**	**1**	2	b1, c1, b2, d2
Number of Weeks /and Units Per Semester		**15**	**30**	

V. Teaching Strategies of the Course:

- Interactive lectures & examples,
- Presentation/seminar,
- Interactive class discussions,
- Laboratory/Practical experiments-based session,
- Directed self- study,
- 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,
- Home works and assignments,
- Presentations.

VII. Assignments:

No	Assignments	Aligned CILOs(symbols)	Week Due	Mark
1	Assignment on Lectures 1,2,3, and 4	a1, a2, c2, d2	5	4
2	Assignment on Lectures 5,6,7, and 9	a1, a2, b1, d2	10	3
3	Assignment on Lectures 10,11, and12	a1, a2, b1, d2	13	3
Total				10

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	Assignments	5, 10, 14	10	7%	a1, a2, b1, d2
2	Quiz 1	4	5	3%	a1, a2
3	Midterm Theoretical Exam	8	20	13.5%	a1, a2, b1
4	Midterm Practical Exam	9	20	13.5%	b1, c1, b2, d2, d1
5	Quiz 2	12	5	3%	a1, a2
6	Final Practical Exam	15	30	20%	b1, c1, b2, d2
7	Final Theoretical Exam	16	60	40%	a1, a2, b1, c2
Total			150	100%	

IX. Learning Resources:

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

1. Ernesto Iadanza, 2020, **Clinical Engineering Handbook**, 2nd Ed., UK, Elsevier Inc., Academic Press.
2. James T. Tweedy, 2014, **Healthcare Hazard Control and Safety Management**, 3rd Ed., USA, Taylor & Francis Group, CRC Press.

2- Essential References.

1. John G. Webster, Amit J. Nimunkar, 2020, **Medical Instrumentation: Application and Design**, 5th Ed., USA, John Wiley & Sons Ltd.
2. Singh Anantpreet, Kaur Sukhjit, 2012, **Biomedical Waste Disposal**, India, Jaypee Brothers Medical Publishers (P) Ltd.

3- Electronic Materials and Web Sites *etc*.

Websites:

1- Recommended Practices for Safety and Health Programs, Occupational Safety & Health Administration, US Department of Labor, US.

https://www.osha.gov/safety-management

2- The National Institute for Occupational Safety and Health (NIOSH), U.S. Department of Health & Human Services, US.

https://www.cdc.gov/niosh/index.htm

3- Health and safety in the laboratory and field, OpenLearn, The Open University, England.

4- https://www.open.edu/openlearn/science-maths-technology/health-and-safety-the-laboratory-and-field/content-section-0?intro=1

Journals:

1- Biosafety and Health, Elsevier.

https://www.journals.elsevier.com/biosafety-and-health

2- Journal of Hazardous Materials, Elsevier.

https://www.journals.elsevier.com/journal-of-hazardous-materials

3- Journal of Health Education Research & Development, Hilaris publisher, Belgium.

4- https://www.hilarispublisher.com/contact-us.html

	Other Web Sources: 1- Website: Robotics and Mechatronics Network, http://kn.theiet.org/communities/robotics/index.cfm 2- Website: Mechatronics Design Center, http://www.microchip.com/stellent/idcplg?IdcService=SS_GET_PAGE&nodeId=1482

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)

Safety in Biomedical Engineering
BE372

I. Course Identification and General Information:						
1	**Course Title:**	Safety in Biomedical Engineering				
2	**Course Code & Number:**	BE372				
3	**Credit Hours:**	**Credit Hours**	**Theory Hours**		**Lab. Hours**	
			Lecture	**Exercise**		
		3	3	--	2	
4	**Study Level/ Semester at which this Course is offered:**	4^{th} Level / 2^{nd} Semester				
5	**Pre –Requisite (if any):**	Biomedical Sensors and Measurements (BE224), Biomedical Equipment I (BE263), Biomedical Equipment II (BE364).				
6	**Co –Requisite (if any):**	Hospital Systems: Design & Management (BE374), Biomedical Equipment III (BE365), Biomedical Systems Design (BE367)				
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. Waleed Al-talabi				
11	**Reviewed by:**	Dr. Mohammed Al-olofi				
12	**Date of Approval:**					

I. Course Identification and General Information:

II. Course Description:

The Safety in Biomedical Engineering course introduces students to the requirements methods and practices to identify and manage applicable safety in a work environment. Students will learn how to achieve optimum safety in risky environments due to electrical wiring and other unsafe equipment and/or due to health conditions in microbial, radiation, or polluted ambience. The course topics include: basic definitions, biomedical hazard recognition, electrical & patient safety, fire safety, radiation safety, laser and ultraviolet (UV) radiation safety, laboratory safety, infection control and prevention, biomedical hazard control, biomedical waste management, and regulatory requirement for healthcare and medical device.

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 key concepts, types and measures related to biomedical hazards and safety in healthcare systems.
a2	Identify workplace hazards, their impact and the guidelines of precautionary and safety measures in healthcare.
B. Intellectual Skills: Upon successful completion of the course, students will be able to:	
b1	Analyze biomedical hazards infections, wastes, and accidents and suggest methods and equipment to respond to an incident, reduce and control risks in the workplace.
b2	Design efficient safety facility and control measures and waste disposal procedures in hospitals and healthcare facilities.
C. Professional and Practical Skills: Upon successful completion of the course, students will be able to:	
c1	Conduct appropriate experimentation related to electrical and fire hazards to assess risks using science-based approaches.
c2	Integrate the law and regulatory requirements for healthcare and medical devices to maximize

III. Course Intended Learning Outcomes (CILOs): (مخرجات تعلم المقرر)	
	the safety and health conditions in the workplace.
D. Transferable Skills: Upon successful completion of the course, students will be able to:	
d1	Work collaboratively as an effective member or leader of diverse teams in risky environments and within constraints.
d2	Acquire skills to effectively manage issues related to biomedical hazards and safety.

IV. Course Contents:

A. Theoretical Aspect:

No.	Units/Topics List	Sub Topics List	Number of Weeks	Contact Hours
1	**Introduction**	– Introduction to the course. – Course outlines. – Project description. – Overview on biomedical hazards and safety (Definitions - Types).	1	2
2	**Biomedical Hazards**	– Common hazards in the workplace, their effects and symptoms and manage them. – **Electrical Hazards** (Sources, Effect, and Protection). – **Mechanical Hazards** (Sources, Effect, and Protection). – Mechanical/Electrical/Hydraulic/Pneumatic actuation. – **Biological Hazard** (Sources, Effect, and Protection). – **Chemical Hazards** (Sources, Effect, and Protection). – **Temperature Hazards** (Sources,	2	4

IV. Course Contents:

A. Theoretical Aspect:

No.	Units/Topics List	Sub Topics List	Number of Weeks	Contact Hours
		Effect, and Protection). – **Radiation Hazards** (Sources, Effect, and Protection). – **Psychosocial Hazards** (Sources, Effect, and Protection). – Psychosocial Annoyance.		
3	**Electrical &Patient Safety**	– Physiological effects of electricity. – Important susceptibility parameters. – Distribution of electric power. – Sources of shocks, macro & micro shocks. – Basic approaches to shock protection. – Leakage Currents (Hazards, monitoring and interrupting the operation). – Protection: power distribution. – Protection: equipment design. – Electrical safety analyser. – Testing the electric system. – Tests of electric appliances. – Testing of biomedical equipment. – Electrical-safety codes and standards for medical equipment.	2	4
4	**Fire Safety**	– Elements of fire, causes of fire.	1	2

IV. Course Contents:

A. Theoretical Aspect:

No.	Units/Topics List	Sub Topics List	Number of Weeks	Contact Hours
		– Action to be taken in case of fire in hospital. – Fire safety management.		
5	**Radiation Safety**	– Design and description of nuclear medicine department. – Radiation protection in nuclear industry. – Guidelines for radiation protection. – Molecular medicine and radiation safety program. – Procedures for safe operation of radiation equipment. – Radiation protection in external beam radiotherapy. – Radiation protection in brachytherapy. – Radioactive wastes.	1	2
6	**Mid-Term Theoretical Exam**	All previous topics	1	2
7	**Laser and Ultraviolet (UV) Radiation Safety**	– Classification of UV radiation. – Sources of UV. – Biological effects of UV. – Hazards associated with UV radiation. – UV control measures. – Safety management of UV.	1	2

IV. Course Contents:

A. Theoretical Aspect:

No.	Units/Topics List	Sub Topics List	Number of Weeks	Contact Hours
		– Classifications of LASER and its radiation hazards. – Control measures. – Emergencies and incident procedures.		
8	**Laboratory Safety**	– Introductory information. – Understanding the hazards of chemicals. – Working safety with hazardous materials. – Emergency response.	1	2
9	**Infection Control and Prevention**	– Healthcare immunizations. – Centres for disease control and prevention. – Disinfectants, sterilant, and antiseptics. – OSHA blood borne pathogens standard, tuberculosis, healthcare opportunistic infections.	1	2
10	**Biomedical Hazard Control**	– Introduction. – Hazard control management. – Hazard control responsibilities. – Addressing behaviours. – Hazard control practice. – Hazard analysis. – Hazard control and correction.	2	4

IV. Course Contents:

A. Theoretical Aspect:

No.	Units/Topics List	Sub Topics List	Number of Weeks	Contact Hours
		– Personal protective equipment. – Hazard control committees. – Hazard control evaluation. – System safety. – Understanding accidents: (Accident causation theories, human factors, accident deviation models, reporting, investigations, analysis, prevention, workers' compensation, orientation, education and training).		
11	**Biomedical Waste Management**	– Types of biomedical wastes. – Major and minor sources of waste. – Categories and classification of biomedical waste. – Hazard of biomedical waste. – Need for disposal of biomedical waste. – Waste minimization. – Waste segregation and labelling. – Waste handling, collection, storage and transportation. – Treatment and disposal.	1	2
12	**Regulatory Requirement for Healthcare and**	– Systems approach to medical device safety. – Medical device standards,	1	2

IV. Course Contents:

A. Theoretical Aspect:

No.	Units/Topics List	Sub Topics List	Number of Weeks	Contact Hours
	Medical Device	regulations, and the law. – Need for standards and their development.		
13	**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	Select a specific biomedical hazard from the list that provided in the second lecture, then analyze the hazard and develop control schemes to eliminate or mitigate it.	2	4
2	Electrical safety fundamentals experiments.	1	2
3	- Electrical safety analyzer.	1	2
4	- Leakage currents test.	1	2
5	- Basic methods to protection against shock.	1	2
6	- Power and electrical distribution protection (Circuit Breakers)	1	2
7	Power and electrical distribution protection (Earthing)	1	2
8	- **Mid-Term Practical Exam**	1	2
9	Electrical system testing.	1	2

B. Case Studies and Practical Aspect:			
No.	**Tasks/ Experiments**	**Number of Weeks**	**Contact Hours**
10	- Fire system safety and alarms.	1	2
11	- Some LASER applications.	1	2
12	- **Project/ Presentation**	1	2
13	- **Final Practical Exam**	**1**	2
Number of Weeks /and Units Per Semester		**15**	**30**

V. Teaching Strategies of the Course:

- Interactive lectures & examples,
- Presentation/seminar,
- Interactive class discussions,
- Laboratory/Practical experiments-based session,
- Directed self- study,
- 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,
- Home works and assignments,
- Presentations.

VII. Assignments:

No.	Assignments	Week Due	Mark
1	Assignment on Lectures 1,2,3, and 4	5	4
2	Assignment on Lectures 5,6,7, and 9	10	3
3	Assignment on Lectures 10,11, and12	13	3
Total			10

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

No.	Assessment Method	Week Due	Mark	Proportion of Final Assessment
1	Assignments	5, 10, 14	10	7%
2	Quiz 1	4	5	3%
3	Midterm Theoretical Exam	8	20	13.5%
4	Midterm Practical Exam	9	20	13.5%
5	Quiz 2	12	5	3%
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:*

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

1- Ernesto Iadanza, 2020, **Clinical Engineering Handbook**, 2nd Ed., UK, Elsevier Inc., Academic Press.

2- James T. Tweedy, 2014, **Healthcare Hazard Control and Safety Management**, 3rd Ed., USA, Taylor & Francis Group, CRC Press.

2- Essential References:

1- John G. Webster, Amit J. Nimunkar, 2020, **Medical Instrumentation: Application and Design**, 5th Ed., USA, John Wiley & Sons Ltd.

2- Singh Anantpreet, Kaur Sukhjit, 2012, **Biomedical Waste Disposal**, India, Jaypee Brothers Medical Publishers (P) Ltd.

3- Electronic Materials and Web Sites etc.:

Websites:

1- Recommended Practices for Safety and Health Programs, Occupational Safety & Health Administration, US Department of Labor, US.

https://www.osha.gov/safety-management

2- The National Institute for Occupational Safety and Health (NIOSH), U.S. Department of Health & Human Services, US.

https://www.cdc.gov/niosh/index.htm

3- Health and safety in the laboratory and field, OpenLearn, The Open University, England.

4- https://www.open.edu/openlearn/science-maths-technology/health-and-safety-the-laboratory-and-field/content-section-0?intro=1

Journals:

1- Biosafety and Health, Elsevier.

https://www.journals.elsevier.com/biosafety-and-health

2- Journal of Hazardous Materials, Elsevier.

https://www.journals.elsevier.com/journal-of-hazardous-materials

3- Journal of Health Education Research & Development, Hilaris publisher, Belgium.

IX. Learning Resources:

4- https://www.hilarispublisher.com/contact-us.html

Other Web Sources:

1- Website: Robotics and Mechatronics Network, http://kn.theiet.org/communities/robotics/index.cfm

2- Website: Mechatronics Design Center, http://www.microchip.com/stellent/idcplg?IdcService=SS_GET_PAGE&nodeId=1482

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.