Republic of Yemen

Ministry of Higher Education & Scientific Research

21 SEPTEMBER UNIVERSITY for MEDICALS & APPLIEED

SCIENCES

Faculty of Engineering and Computer

Department of Biomedical Engineering

Course Specification of

Safety in Biomedical Engineering

Course No. (07.02.728)

2024/2025

Prepared by:	Reviewed by:	Head of the	Quality Unit:	Dean:

		Department:		
Dr. Ammar Ali Ali Abdu	Dr. -----	Dr. Awadh Al-Kubati	Dr. Mohammed Al-Shamahi	Dr. Abdulrahman Obaid

I. Course Identification and General Information:

1	Course Title:	Safety in Biomedical Engineering			
2	Course Code & Number:	07.02.728			
3	Credit Hours:	Credit Hours	Theory Hours		Lab. Hours
			Lecture	Exercise	
		3	2	--	1
4	Study Level/ Semester at which this Course is offered:	3 Level / 2 Semester			
5	Pre –Requisite (if any):	Biomedical Sensors and Measurements , Biomedical Equipment I, Biomedical Equipment II.			
6	Co –Requisite (if any):	Hospital Systems: Design & Management , Biomedical Equipment III, Biomedical Systems Design			
7	Program (s) in which the Course is Offered:	Biomedical Engineering Technology			
8	Language of Teaching the Course:	English			
9	Study System:	Regular (semester)			
10	Mode of Delivery:				
11	Location of Teaching the Course:	University Campus			
12	Prepared by:	Dr. Ammar Ali Ali Abdu			
13	Date of Approval:				

Prepared by:	Reviewed by:	Head of the Department:	Quality Unit:	Dean:
Dr. Ammar Ali Ali Abdu	Dr. -----	Dr. Awadh Al-Kubati	Dr. Mohammed Al-Shamahi	Dr. Abdulrahman Obaid

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)		Referenced PILOs (مخرجات تعلم البرنامج)	
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.	A1	Explain the appropriate models, theories, mathematical foundations, and techniques related to biomedical engineering technology context.
a2	Identify workplace hazards, their impact and the guidelines of precautionary and safety measures in healthcare.	A3	Recognize the user and healthcare needs to provide based solutions on a high level of management, professional and ethical behavior, responsibility, standards, health and safety requirements in biomedical systems to real-healthcare problem.
B. Intellectual Skills: Upon successful completion of the course, students will be able to:			
b1	Analyze biomedical hazards infections, wastes, and accidents	B2	Analyze the impacts of problems related to the Biomedical

	and suggest methods and equipment to respond to an incident, reduce and control risks in the workplace.		equipments and its solution principles in a creative manner by using a systematic and analytical thinking methods.
b2	Design efficient safety facility and control measures and waste disposal procedures in hospitals and healthcare facilities..	B3	Assess the features of biomedical devices systems, engineering diagnostic skills, technological expertise, and analytical methods that related to identify and addressing of biomedical devices systems failures.
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.	C1	Relate integrally knowledge of life science, biomedical engineering technology practice concepts, principles of engineering and techniques evaluation to solve problems 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.	C2	Evaluate an engineering technique, modern analytical tools and required computer programs to analyzing and solve the problems of medical devices.
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.	D1	Function effectively as an individual, team member, or leader in activities relevant to biomedical engineering, and collaborating to achieve a shared objective.
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 of Course Intended Learning Outcomes (Knowledge and

Prepared by:	Reviewed by:	Head of the Department:	Quality Unit:	Dean:
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Understanding) to Teaching Strategies and Assessment Methods:			
	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.	▪ Lectures ▪ Discussion ▪ Assignment ▪ Self-learning ▪ Directed self- study ▪ Presentation/seminar,	▪ Written Exam and quizzes. ▪ Observations. ▪ Reports evaluation. ▪ Presentations.
a2	Identify workplace hazards, their impact and the guidelines of precautionary and safety measures in healthcare.		
(B) Alignment of Course Intended Learning Outcomes (Intellectual Skills) to Teaching Strategies and Assessment Methods:			
	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.	▪ Exercises and problems solving. • Tutorials, • Presentation/seminar, • Interactive class discussions, • Directed self- study, • Team work (cooperative learning), • Field visits/training.	▪ Written Exam and quizzes. ▪ Observations. ▪ Reports evaluation. ▪ Home works and assignments, ▪ Presentations.
b2	Design efficient safety facility and control measures and waste disposal procedures in hospitals and healthcare facilities.		
(C) Alignment of Course Intended Learning Outcomes (Professional and Practical			

Skills) to Teaching Strategies and Assessment Methods:			
	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, ▪ Presentation/seminar, ▪ Interactive class discussions, • Laboratory/Practical experiments based session, • Directed self-study, • Team work (cooperative learning), • Field visits/training, • Mini/major project.	▪ Reports evaluation. ▪ Observations. ▪ 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.		

(D) Alignment of Course Intended Learning Outcomes (Transferable Skills) to Teaching Strategies and Assessment Methods:			
	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,	• Written tests (mid and final terms and quizzes), • Home works and assignments, • Presentations.

		• Mini/major project.	
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.

IV. Course Contents:

A. Theoretical Aspect:

No.	Units/Topics List	Sub Topics List	Number of Weeks	Contact Hours	Learning Outcomes (CILOs)
1	**Introduction**	– Introduction to the course. – Course outlines. – Project description. – Overview on biomedical hazards and safety – (Definitions - Types).	1	2	a1, a2
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).	2	4	a1,a2

		– **Temperature Hazards** (Sources, 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	a1,a2,b1 ,b2,c1
4	**Fire Safety**	- Elements of fire, causes of fire. - Action to be taken in case of fire in hospital. - Fire safety management.	1	2	a2,b1
5	**Radiation Safety**	– Design and description of nuclear medicine department. – Radiation protection in nuclear industry.	1	2	a2, b1

		– 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.			
6	**Mid-Term Theoretical Exam**	All previous topics	1	2	a1, a2, b1
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. – Classifications of LASER and its radiation – hazards. – Control measures. – Emergencies and incident procedures.	1	2	a1, a2, b1
8	**Laboratory Safety**	- Introductory information. - Understanding the hazards of chemicals. - Working safety with hazardous materials. - Emergency response.	8	2	a1, a2, b1
9	**Infection Control and**	– Healthcare immunizations. – Centres for disease control	1	2	a1, a2, b1

	Prevention	and prevention. – Disinfectants, sterilant, and antiseptics. – OSHA blood borne pathogens standard, – tuberculosis, healthcare opportunistic infections.			
10	**Biomedical Hazard Control**	– Introduction. – Hazard control management. – Hazard control responsibilities. – Addressing behaviours. – Hazard control practice. – Hazard analysis. – Hazard control and correction. – 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).	10	2	b1,b2,c1 ,c2
11	**Biomedical Waste Management**	– Types of biomedical wastes. – Major and minor sources of waste. – Categories and classification of biomedical	1	2	a1, a2, b1, c2

		– 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.			
12	**Regulatory Requirement for Healthcare and Medical Device**	- Systems approach to medical device safety. - Medical device standards, regulations, and the law. - Need for standards and their development.	1	2	a2, b1, c2
13	**Final Theoretical Exam**	– All topics	1	2	a1, a2, b1, c2
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**	

Prepared by:	Reviewed by:	Head of the Department:	Quality Unit:	Dean:
Dr. Ammar Ali Ali Abdu	Dr. -----	Dr. Awadh Al-Kubati	Dr. Mohammed Al-Shamahi	Dr. Abdulrahman Obaid

B. Case Studies and Practical Aspect:

No.	Tasks/ Experiments	Number of Weeks	Contact Hours	Learning Outcomes (CILOs)
1	Laboratory Initialization and Rules and Matlab overview.	1	2	a1,a2 ,b1,b2, c1,c2,d1
2	Discrete and Continuous-Time Signals.	2	4	
3	Discrete-Time Signals	2	4	
4	Frequency Analysis	1	2	
5	Sampling and Reconstruction	2	4	
6	Digital filter Design	2	4	
7	DFT and FFT	2	4	
Number of Weeks /and Units Per Semester		12	24	

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.

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VII. Assignments:

No.	Assignments	Week Due	Mark	Aligned CILOs (symbols)
1	Assignment on Lectures 1,2,3, and 4	5	4	a1, a2, c2, d2
2	Assignment on Lectures 5,6,7, and 9	10	3	a1, a2, b1, d2
3	Assignment on Lectures 10,11, and12	13	3	a1, a2, b1, d2
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			100	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- 1. John G. Webster, Amit J. Nimunkar, 2020, Medical Instrumentation: Application and Design, 5th Ed., USA, John Wiley & Sons Ltd.

2- 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.

-3 https://www.hilarispublisher.com/contact-us.html

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- **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: (Based on the Uniform Students' By law (2007) تترك كما هي

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	**lagiarism:** 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.

Second Part of Course Specification

Faculty of Medical Technology

Department of Biomedical Engineering Technology

Course Specification of

Safety in Biomedical Engineering Course No. (07.02.728)

I. Information about Faculty Member Responsible for the Course:							
Name of Faculty Member:	Dr. Ammar Ali Ali Abdu						
Location& Telephone No.:	Sanaa - 775207752						
E-mail:	dr.ammar.ali2018@gmail.com	SAT	SUN	MON	TUE	WED	THU
Office Hours							

Prepared by:	Reviewed by:	Head of the Department:	Quality Unit:	Dean:
Dr. Ammar Ali Ali Abdu	Dr. -----	Dr. Awadh Al-Kubati	Dr. Mohammed Al-Shamahi	Dr. Abdulrahman Obaid

2024/2025

I. Course Identification and General Information:					
1	Course Title:	Safety in Biomedical Engineering			
2	Course Code & Number:	07.02.728			
3	Credit Hours:	Credit Hours	Theory Hours		Lab. Hours
			Lecture	Exercise	
		3	2	--	1
4	Study Level/ Semester at which this Course is offered:	3 Level / 2 Semester			
5	Pre –Requisite (if any):	Biomedical Sensors and Measurements , Biomedical Equipment I, Biomedical Equipment II			
6	Co –Requisite (if any):	Hospital Systems: Design & Management , Biomedical Equipment III, Biomedical Systems Design			
7	Program (s) in which the Course is Offered:	Biomedical Engineering Technology			
8	Language of Teaching the Course:	English			
9	Study System:	Regular (semester)			
10	Mode of Delivery:				
11	Location of Teaching the Course:	University Campus			
12	Prepared by:	Dr. AMMAR ALI ALI ABDU			
13	Date of Approval:				

II. Course Description:

Prepared by:	Reviewed by:	Head of the Department:	Quality Unit:	Dean:
Dr. Ammar Ali Ali Abdu	Dr. -----	Dr. Awadh Al-Kubati	Dr. Mohammed Al-Shamahi	Dr. Abdulrahman Obaid

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 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	Learning Outcomes (CILOs)
1	**Introduction**	– Introduction to the course. – Course outlines. – Project description. – Overview on biomedical hazards and safety – (Definitions - Types).	1	2	a1, a2
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, Effect, and Protection). – **Radiation Hazards** (Sources, Effect, and Protection). – **Psychosocial Hazards** (Sources, Effect, and Protection).	2	4	a1,a2

		– 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	a1,a2,b1 ,b2,c1
4	**Fire Safety**	- Elements of fire, causes of fire. - Action to be taken in case of fire in hospital. - Fire safety management.	1	2	a2,b1
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	1	2	a2, b1

		beam radiotherapy. – Radiation protection in brachytherapy. – Radioactive wastes.			
6	**Mid-Term Theoretical Exam**	All previous topics	1	2	a1, a2, b1
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. – Classifications of LASER and its radiation – hazards. – Control measures. – Emergencies and incident procedures.	1	2	a1, a2, b1
8	**Laboratory Safety**	- Introductory information. - Understanding the hazards of chemicals. - Working safety with hazardous materials. - Emergency response.	8	2	a1, a2, b1
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	a1, a2, b1

10	**Biomedical Hazard Control**	– Introduction. – Hazard control management. – Hazard control responsibilities. – Addressing behaviours. – Hazard control practice. – Hazard analysis. – Hazard control and correction. – 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).	10	2	b1,b2,c1 ,c2
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.	1	2	a1, a2, b1, c2

		– Waste handling, collection, storage and – transportation. – Treatment and disposal.			
12	**Regulatory Requirement for Healthcare and Medical Device**	- Systems approach to medical device safety. - Medical device standards, regulations, and the law. - Need for standards and their development.	1	2	a2, b1, c2
13	**Final Theoretical Exam**	– All topics	1	2	a1, a2, b1, c2
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
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		**14**	**28**

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:

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:

4- 1. John G. Webster, Amit J. Nimunkar, 2020, Medical Instrumentation: Application

and Design, 5th Ed., USA, John Wiley & Sons Ltd.

5- 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.

-6 https://www.hilarispublisher.com/contact-us.html

- **Other Web Sources:**

-2 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: (Based on the Uniform Students' By law (2007) تترك كما هي

1	**Class Attendance:** Class Attendance is mandatory. A student is considered absent and shall be banned from taking the final exam if his/her absence exceeds (15 without excuses 25% with

	excuses).
2	**Tardiness:** A student will be considered late if he/she is not in class after 10 minutes of the start time of class.
3	**Exam Attendance/Punctuality:** No student shall be allowed to the exam hall after 30 minutes of the start time, and shall not leave the hall before half of the exam time has passed.
4	**Assignments & Projects:** Assignments and projects must be submitted on time. Students who delay their assignments or projects shall lose the mark allocated for the same.
5	**Cheating:** Cheating is an act of fraud that results in the cancelation of the student's exam or assignment. If it takes place in a final exam, the penalties stipulated for in the Uniform Students' Bylaw (2007) shall apply.
6	**Forgery and Impersonation:** Forgery/Impersonation is an act of fraud that results in the cancelation of the student's exam, assignment or project. If it takes place in a final exam, the penalties stipulated for in the Uniform Students' Bylaw (2007) shall apply.
7	**Other policies:** The University official regulations in force will be strictly observed and students shall comply with all rules and regulations of the examination set by the Department, Faculty and University Administration.

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