Course Unit Title	Biomedical Signal Processing
Course Unit Code	BME452
Type of Course Unit	Technical Elective
Level of Course Unit	4th year BSc program
National Credits	3
Number of ECTS Credits Allocated	5
Theoretical (hour/week)	4
Practice (hour/week)	-
Laboratory (hour/week)	-
Year of Study	4
Semester when the course unit is delivered	7
Course Coordinator	Ali Işın
Name of Lecturer (s)	Ali Işın
Name of Assistant (s)	-
Mode of Delivery	Face to Face.
Language of Instruction	English
Prerequisites	-
Recommended Optional Programme Components	

Course description:
This course is designed for biomedical engineering undergraduate students. The purpose of this course is to provide biomedical signal processing background on technical aspects. Fundamentals of digital signal processing, signal conditioning, frequency analyses, digital filtering methods, feature extraction, classification and application on EEG-ECG signals are introduced in detail. Students are provided with overviews of major techniques that engineers have used to explore in biomedical engineering level.

Objectives of the Course:
Signal Processing:

1. Understand the mathematical principles of continuous and digital signal processing**.** Apply knowledge of math, engineering and science to identify, formulate, and solve problems in these areas.
2. **Biomedical Signal Processing:** Apply knowledge of math, engineering and science to understand the principle of biomedical signal processing. Understand how to apply specific mathematical techniques to solve problems in the areas of biomedical signals (e.g., calculation of an ECG spectrum using Fourier Series and calculation of Heart Rate Variability using Fourier Transforms).

Learning Outcomes

At the end of the course the student should be able to		Assessment
1	Develop a thorough understanding on basics of digital signals and biological signals.	1
2	Develop a thorough understanding on basics of signal pre-processing and digital filtering	1, 2
3	Develop a thorough understanding on basics of ECG and EEG feature extraction.	1, 2
4	Develop a thorough understanding on basics of ECG pattern recognition and classification algorithms.	1, 2

Assessment Methods: 1. Written Exam, 2. Assignment

Course's Contribution to Program

		CL
1	Apply knowledge of mathematics, natural science with relevant to life science and multidisciplinary context of engineering science.	4
2	Analyse, design and conduct experiments, as well as to analyse and interpret data.	4
3	Design a system, component or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability and sustainability.	3
4	Function on multidisciplinary teams.	3
5	Control in design work, by using simulation, modelling and tests and integration in a problem solving oriented way.	3
6	Display an understanding of professional and ethical responsibility.	4
7	Communicate effectively aware of the non-technical effects of engineering.	1
8	Search technical literature and other information sources.	1
9	Recognize of the need for, and an ability to engage in life-long learning.	2
10	Exhibit a knowledge of contemporary issues.	2
11	Use the techniques, skills and modern engineering tools necessary for engineering practice to develop marketable products for the global market.	3

CL: Contribution Level (1: Very Low, 2: Low, 3: Moderate, 4: High, 5: Very High)

Course Contents

Week	Chapter	Topics	Assessment
1		Introduction to digital and biological signals	
2	1	Classification of Signals	
3	1	Discrete Time Signals and Systems – Analogue to Digital Conversion	1st Homework assigned
4	1	Classification of Discrete Time Systems and Basic System Operations	
5	2	Signal Conditioning: Mean, Correlation and Ensemble Averaging	
6	2	Median Filtering, Moving Average Filtering and Principal Component Analysis	1st Homework due.
7			Midterm Exam
8	3	Digital Filtering: Filtering in frequency domain	
9	3	Digital Filtering: Filtering in time domain	2nd Homework Assigned
10	3	-Introduction to ECG, PCG and CP -Event Detection	
11	3	QRS Detection	
12	4	-Introduction to EEG and EP -Biological Signal Feature Extraction	
13	4	Classification methodologies for biological signals	2nd Homework due
14	5	Neural Network Classifiers	
15			Final Exam.

Recommended Sources

Textbook:

- D.C. Reddy: Biomedical Signal Processing: Principles and Techniques, Tata McGraw-Hill Education, ISBN 10: 0070583889 / ISBN 13: 9780070583887

Assessment

Attendance	5%	Less than 25% class attendance results in NA grade
Midterm Exam	30%	Written Exam
Assignments	10%	
Final Exam	55%	Written Exam
Total	100%	

Assessment Criteria

Final grades are determined according to the Near East University Academic Regulations for Undergraduate Studies

Course Policies

1. Attendance to the course is mandatory.
2. Late assignments will not be accepted unless an agreement is reached with the lecturer.
3. Students may use calculators during the exam.
4. Cheating and plagiarism will not be tolerated. Cheating will be penalized according to the Near East University General Student Discipline Regulations

ECTS allocated based on Student Workload

Activities	Number	Duration (hour)	Total Workload (hour)
Course duration in class (including Exam weeks)	15	4	60
Labs and Tutorials	5	2	10
Assignment	2	4	8
Project/Presentation/Report	-	-	-
E-learning activities	-	-	-
Quizzes	-	-	-
Midterm Examination	1	8	8
Final Examination	1	16	16
Self-Study	15	4	60
Total Workload			162
Total Workload/30(h)			5.4
ECTS Credit of the Course			5