NEAR EAST UNIVERSITY

BIOMEDICAL ENGINEERING

PHD COURSE HANDBOOK

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MISSION, VISION, AIMS AND ORGANIZATION OF BIOMEDICAL ENGINEERING PHD PROGRAM

MISSION

Our mission is to achieve an international reputation for educating biomedical engineering leaders and to promote learning and research that integrate engineering and life sciences for the advancement of human health.

VISION

The vision of the program is to develope a collaborative interdisciplinary research and education with global impact on improving human health.

AIMS

The aim of the program is to prepare students for careers in industry, academia, health care, or government, and to advance research in biomedical engineering. The biomedical engineering department provides a learning and research environment that encourages students to apply biomedical engineering methods to integrate knowledge across the spectrum from basic cellular and molecular biology through tissue, organ, and whole body physiology. The research programs in the Biomedical Engineering department exploit knowledge to design medical diagnostic and therapeutic technologies that improve human health.

ORGANIZATION

Doctor of Philosophy program consist of seven courses, one seminar course and a thesis with total 21 credit hours. The seminar course and thesis are non-credit and graded on a satisfactory basis. In order to graduate, student have to maintain a minimum cumulative GPA of 3.00/4.00 at the end of study. The Biomedical engineering Department offers full and part time Doctor of Philosophy program. The period for full time PhD program is minimum 8, and maximum 10 semesters. The period for part time PhD program is minimum 8, maximum 12 semesters.

The dissertation to be prepared at the end of the doctoral program must meet one of the following criteria:

a) Introducing an innovation in a scientific field,

b) Developing a new scientific method,

c) Applying an already-known method to a new area.

LIST OF COURSES

Course Code	Course Title	T	A	C	Compulsory/Elective
BME600	PhD Thesis I	0	0	0	Compulsory
BME601	PhD Thesis II	0	0	0	Compulsory
BME602	Seminar in Biomedical Engineering	0	2	0	Compulsory
BME603	Advance Bioinformatics	3	0	3	Elective
BME604	Mathematical and Computational Methods in Biomechanics of Human	3	0	3	Elective
BME605	Advanced Image Processing	3	0	3	Elective
BME606	Information Theory and Coding	3	0	3	Elective
BME607	Advanced Biomedical Signal - Image Processing	3	0	3	Elective
BME610	Biomaterials for Medical Diagnosis and Therapy	3	0	3	Elective
BME611	Magnetic Resonance Imaging	3	0	3	Elective
BME612	Advance Artificial Organs	3	0	3	Elective
BME618	Ultrasound Imaging and Doppler Techniques	3	0	3	Elective
BME620	Advance Biostatistics	3	0	3	Elective
BME622	Clinical Engineering	3	0	3	Elective
BME632	Pattern Recognition	3	0	3	Elective
BME633	Physics in Nuclear Medicine	3	0	3	Elective
BME634	Advanced Microprocessors	3	0	3	Elective
BME643	Advanced Tissue Engineering	3	0	3	Elective
BME655	Biomedical Micro and Nano Systems	3	0	3	Elective
BME660	Advance Biomechanical Cardiovascular Systems	3	0	3	Elective
BME662	Biomedical Research Methods	3	0	3	Compulsary
BME670	Advanced Electromagnetics and Its Biomedical Applications	3	0	3	Elective
BME680	Advance Artificial Neural Networks	3	0	3	Elective
BME682	Bioeffects and Therapeutic Applications of Electromagnetic Energy	3	0	3	Elective
BME690	Modeling of Complex Biological Systems	3	0	3	Elective
MAT601	Advanced Applied Mathematics for Engineers	3	0	3	Elective

COURSE DESCRIPTIONS

BME600 PHD THESIS I, BME601 PHD THESIS II

To solve biomedical problems by systems analytical thinking both in subject specific and interdisciplinary concepts. Carry out independent scientific work and organize, conduct and lead more complex projects. Each PhD student is to conduct research in the form of PhD's thesis.

BME602 SEMINAR IN BIOMEDICAL ENGINEERING

Each PhD student is required to present his/her research findings to students and instructors. The literature review of the research and fist findings are important.

BME603 ADVANCE BIOINFORMATICS

This course is graduate level bioinformatics course, which emphasizes as a basis for understanding bioinformatics and their applications. The course focuses on a general introduction to the uses of biological databases in the generating biological knowledge to better understand living systems, for purposes of aiding healing of diseases. Topics include Genomic Era, the anatomy of genome, probabilistic models of genome sequences, biological databases, sequence alignment, gene and promoter prediction, molecular phylogenetics, post-genomic epidemic, structural bioinformatics and proteomics. This course covers the fundamental concepts molecular biology, database management systems, and probabilistic models.

BME604 MATHEMATICAL AND COMPUTATIONAL METHODS IN BIOMECHANICS OF HUMAN

Biomechanics of the human skeleton and the problem of alloarthroplasty, introduction to the anatomy of the skeletal system, total replacement of human joints, mathematical models of biomechanics, background of biomechanics, mathematical models of particular parts of the human skeleton and joints and their replacements based on boundary value problem analyses, mathematical analyses and numerical solutions of fundamental biomechanical problems, biomechanical analyses of particular parts of the human skeleton, joints, and their replacements, biomechanical models based on contact problems and biomechanical analyses of some human joints, their total replacements, and some other parts of the human skeleton.

BME605 ADVANCE IMAGE PROCESSING

Introduction to medical imaging and various medical, imaging systems. Nuclear magnetic moment, nuclear spin, resonance, connector constants, spin systems, MR spectroscopic data processing. Application of MR spectroscopy on brain, muscles, tissue and etc.

BME606 INFORMATION THEORY AND CODING

This course covers intermediate to advanced information theory and channel coding topics. Topics covered include fundamentals of channel coding as well as powerful error-correcting codes such as low-density parity-check codes and turbo codes.

BME607 ADVANCED BIOMEDICAL SIGNAL - IMAGE PROCESSING

This course is designed for biomedical engineering PhD students. The purpose of the course is to provide biomedical signal and image processing background on technical aspects. Fundamentals of digital signal-image processing, signal-image conditioning, frequency analysis, digital filtering methods, feature extraction methods, classification methods and applications on EEG – ECG signals and CT-MRI images are introduced in detail. Students are provided with overviews of the major techniques that engineers have used to explore in biomedical engineering level.

BME610 BIOMATERIALS FOR MEDICAL DIAGNOSIS AND THERAPY

This course highlights the capabilities of biomaterials and devices for patient diagnostics and therapy. It is broken down into four major areas: in vitro and in vivo diagnostics (optical, electrical, mechanical), nanotechnology-enhanced analytical tools and techniques for diagnostics, and the future for patient diagnostics.

BME611 MAGNETIC RESONANCE IMAGING

This course is designed for biomedical engineering PhD students. The purpose of the course is to provide detailed information on technical aspects of magnetic resonance imaging. Biomedical diagnostic magnetic resonance imaging systems and the physical principles of nuclear magnetic resonance imaging are introduced in detail. Students are provided with overviews of the major physical techniques that engineers have used to explore in biomedical engineering level.

BME612 ADVANCE ARTIFICIAL ORGANS

Medical devices that replace the function of one of the major organs in the body must usually interface with flowing blood. Examples include total artificial hearts, left ventricular assist devices, membrane oxygenators, hemodialysis systems and encapsulated endocrine cells. The design of these devices relies on integration of knowledge from a variety of fields, in particular computational fluid dynamics and blood rheology. We will study the process by which a concept for a device eventually leads to a functioning, blood-contacting medical device. An introduction to computational fluid dynamics (the finite difference and finite volume methods) will be integrated with computer-aided design and testing of devices using the software package Fluent.

BME618 – ULTRASOUND IMAGING AND DOPPLER TECHNIQUES

The course is designed for biomedical engineering PhD students. The purpose of the course is to provide detailed information on technical aspects of ultrasound imaging. Biomedical diagnostic ultrasound imaging systems and the physical principles of Ultrasound and Doppler techniques are introduced in detail. Students are provided with overviews of the major physical techniques that engineers have used to explore in biomedical engineering level.

BME620 ADVANCE BIOSTATISTICS

Within this course, students will study multivariate techniques in health care research and apply aspects of complex research designs, including model testing, decision theory, and advanced statistical techniques.

BME622 CLINICAL ENGINEERING

This course is designed for biomedical engineering PhD students. Aim of the course is to provide the fundamental concepts in managing medical technology, establishing and operating a clinical engineering department and the role of the clinical engineer in designing facilities used in patient care. Topics covered included managing safety programs, technology assessment, technology acquisition, the design of clinical facilities, risk management, budgeting and ethical issues of concern to the clinical engineer.

BME632 PATTERN RECOGNITION

This course is designed for biomedical engineering PhD students. Purpose of this course is to provide pattern recognition and classification techniques. Different event detection, feature extraction and classification methods are introduced in detail. Students are provided with overviews of the major techniques that engineers have used to explore in biomedical engineering level.

BME633 PHYSICS IN NUCLEAR MEDICINE

Deep knowledge of conventional nuclear medicine imaging devices. Introduction of radiation detectors. Gamma camera basic principles. Field of application of gamma camera. Performance, cons and pros of gamma camera. Characterizing or evaluating image quality. Limitation of image quality, and approaches to solve it. Tomographic image reconstruction techniques. Conventional image reconstruction techniques such as Ordered Subset Expectation (OSEM) Maximization and Filtered Back Projection (FBP). Basic of Single Photon Emission Computed Tomography (SPECT) and Positron Emission Tomography (PET). State-of-the-art SPECT and PET systems.

BME634 ADVANCED MICROPROCESSORS

Introduction to microprocessors, Architecture of 8-bit microprocessors, PIC microcontroller code sets, Introduction to microprocessor programming, PIC16 and PIC18 series, Advance system design of microprocessors, Connections of microprocessors, memory, input-output and cutting, timing circuits.

BME643 ADVANCE TISSUE ENGINEERING

The course will cover the application of engineering principles, combined with molecular cell biology, to develop fundamental understanding of property function relationships in tissues. Exploitation of the understanding to manipulate cell and tissue properties rationally to alter, restore, maintain, or improve cell and tissue functions as well as to design bioartificial tissue substitutes.

BME655 – BIOMEDICAL MICRO AND NANO SYSTEMS

The course defines the understanding of biomedical micro and nano systems manufacturing techniques. Design, fabrication and operation issues in applications of micro-total analysis systems, drug delivery systems, devices and instrumentation for diagnosis and treatment of human disease will be presented.

BME660 ADVANCE BIOMECHANICAL CARDIOVASCULAR SYSTEMS

Introduction and basic concepts of biomechanics, Dynamics of mechanics, Materials properties of Hard and soft tissues, and mechanical properties, Biomechanical behaviors, Materials for prosthesis and mechanical properties, Applications and behaviors of human body, Biomechanical systems and examples.

BME662 BIOMEDICAL RESEARCH METHODS

The course defines the understanding of science and engineering and describes the links between the interrelated technical subjects. Further, it considers the methods of scientific research and focuses on the five methods mostly widely used for natural sciences and engineering, giving much emphasis on experimental and field studies research methods. It also stresses the importance of integrated research methods. It stresses the important aspects of writing research proposal, presenting and report (thesis) writing. Finally, it provides some information on research ethics and on resolving controversies in research.

BME670 ADVANCED ELECTROMAGNETICS AND ITS BIOMEDICAL APPLICATIONS

Coulomb's Law, Electric Field Intensity, Electric Potential, The Field Outside an Electrically Charged Body, Gauss Law, Poisson's Equation, Laplace's Equation, Conductors, Calculation of the Electric Field Produced by A Simple Cahrge Distribution, Electric Dipole, The Linear Electric Quadrupole, Electric Field Outside An Arbitrary Charge Distribution, Ptential Energy of A Charge Distribution, Energy Density in an Electric Field, Forces on Conductors, Dielectric Materials, Electric Polarization, Electric Field at an Exterior Point, The Bound Charge Densities, Electric Field at an Interior Point, The Electric Susceptibility, Divergence of E and the Dielectric Displacement D, Relative Permittivity, Calculation of Electric Fields Involving Dielectrics, Frequency Dependence, Anisotropy and Nonhomogeneity, Potential Energy of a Charge Distribution in the Presence of Dielectrics, General Methods for Solving Laplace's and Poisson's Equations, Continuity of V, D,E, at the Interface Between Two Dielectric Media, Normal Component of the Electric Displacement, Tangential Component of the Electric Field Intensity, Bending of Lines of Force, The Uniqueness Theorem, Images, Point Charge Near an Infinite Grounded Conducting Plane, Solution of Laplace's Equation in Rectangular Coordinates, Solution of Laplace's Equation in Spherical Coordinates, Solution of Poisson's Equation for E, Magnetic Forces, The Magnetic Induction B, The Biot Savart Law, The Force on a Point Charge Moving in a Magnetic Field, The Divergence of the Magnetic Induction B, The Vector Potential A, The Line Integral of the A over a Closed Curve, The Curl of B, Ampere's Circuital Law, Magnetic Dipole, Faraday Induction Law, Faraday Induction Law in Differential Form, Induced Electric Field Intensity in Terms of the Vector Potential A, Energy Stored in a Magnetic Field, Magnetic Energy in terms of B, Magnetic Energy in terms of J and A, Magnetic Energy in terms of I and Φ, Magnetic Field Intenisty H, Ampere's Circuit Law, The Equivalent Current Density and J, Boundary Conditions, Maxwell Equations, Maxwell Equations in Integral Form, Nonhomogeneous Wave Equations for E and B, Plane Electromagnetic Waves in Free Space, Poynting Vector, The E, H Vectors in Homogeneous, Isotropic, Linear and Stationary Media, Propagation of Plane Electromagnetic Waves in Nonconductors, Propagation of Plane Electromagnetic Waves in Conducting Media, Propagation of Plane Electromagnetic Waves in Good Conductor Media, Reflection and Refraction, The Laws of Reflection and Snell's Law of Refraction, Fresnel's Equations, Refelction and Refraction at the Interface Between Two Nonmagnetic Nonconductors, Guided Waves, Radiation of the Electromagnetic Waves, The Vector Potential A and H, The Electric Field Intensity E, Radiation From a Half-Wave Antenna

BME680 ADVANCE ARTIFICIAL NEURAL NETWORKS

This course explores the organization of synaptic connectivity as the basis of neural computation and learning. Perceptrons and dynamical theories of recurrent networks including amplifiers, attractors, and hybrid computation are covered. Additional topics include backpropagation and Hebbian learning, as well as models of perception, motor control, memory, and neural development.

BME682 BIOEFFECTS AND THERAPEUTIC APPLICATIONS OF ELECTROMAGNETIC ENERGY

Fundamental Concepts in Electromagnetic, Electromagnetic Interactions with Biological Systems, Health Risks of Electromagnetic Energy, Guidelines and Measurement for Electric and Magnetic Fields, Bioeffects of Electric and Magnetic Fields, Radio Frequency Standards and Dosimetry, Bioeffects and Health, Implications of Radio frequency Radiation, Electromagnetic Risk Analysis, Therapeutic Applications of Electromagnetic Energy, Electromagnetic Therapy. Electromagnetic Hyperthermia, Radio Frequency and Microwave Ablation, Dosimetry and Imaging, Electromagnetic and Thermal Dosimetry, Thermometry and Imaging.

BME690 MODELING OF COMPLEX BIOLOGICAL SYSTEMS

This course introduces the current approaches for mathematical modelling and analysis of biological systems using both computer simulation and mathematical techniques. The course reviews the basic of modelling methodology, stochastic and deterministic models, numerical and analytical methods, and model validation. Examples throughout the course are drawn from population dynamics, biochemical networks, ecological models, neuronal modelling, and physiological systems.

MAT601 ADVANCED APPLIED MATHEMATICS FOR ENGINEERS

This course aims to review of vector analysis, complex numbers, review of ordinary differential equations, variation of parameters and Cauchy-Euler differential equations, system of linear differential equations. Laplace Transforms and fourier series, beta gamma functions, bessel2s functions and partial differential equations.

SYLLABUSES

PhD program, Department of Biomedical Engineering

Course Unit Title	PhD Thesis I
Course Unit Code	BME600
Type of Course Unit	Compulsory
Level of Course Unit	PhD program
National Credits	-
Number of ECTS Credits Allocated	10
Theoretical (hour/week)	Varies
Practice (hour/week)	Varies
Laboratory (hour/week)	Varies
Year of Study	2
Semester when the course unit is delivered	3 and 4
Course Coordinator	Assoc. Prof. Dr. TerinAdalı
Name of Lecturer (s) / Supervisor (s)	Depending on the Thesis topic varies
Name of Assistant (s)	-
Mode of Delivery	Face to Face
Language of Instruction	English
Prerequisites	-
Recommended Optional Program Components	

Course description:

To solve biomedical problems by systems analytical thinking both in subject specific and interdisciplinary concepts. Carry out independent scientific work and organize, conduct and lead more complex projects. Each PhD student is to conduct research in the form of PhD thesis.

Objectives of the Course:

Collecting, interpreting, applying, and disseminating related data by taking social, scientific, cultural and ethical values into account.

Learning Outcomes

After completing the course, the student will be able to		Assessment
1	Develop and deepen the knowledge achieved.	2,3,4,5
2	Interpret and integrate knowledge from different disciplines and generate and analyze new information.	2,3,4,5

Assessment Methods: 1. Written Exam, 2. Assignment, 3. Project/Report, 4. Presentation, 5. Lab. Work

Course's Contribution to Program

		CL
1	Apply the rules of scientific research and ethics.	5
2	Discuss complex biomedical engineering issues as well as own research results comprehensively and in the context of current international research and present these in writing and orally.	5
3	Solve problems by systems analytical thinking both in subject specific and interdisciplinary concepts.	5
4	Combine specialized knowledge of various component disciplines.	5
5	Carry out independent scientific work and organize (capacity of teamwork), conduct and lead more complex projects.	4
6	To assess the social and environmental related effects of their actions.	5

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

Course Contents

Week	Topics	Exam
1-30	Conducting research	

Recommended Sources

Books, articles and other scientific documents related to the field

Assessment

Thesis defense 1 0 0 %

Assessment Criteria Final grades are determined according to the Near East University Academic Regulations for Undergraduate Studies
Course Policies Governed by Graduate Education Regulations
ECTS allocated based on Student Workload

Activities	**Number**	**Duration (hour)**	**Total Workload(hour)**
Course duration in class (including Exam weeks)	14	2	28
Labs and Tutorials	-	-	-
Assignment	-	-	-
Project/Presentation/Report	3	10	30
E-learning activities	-	-	-
Quizzes	-	-	-
Midterm Examination	-	-	-
Final Examination	-	-	-
Self-Study	1	40	40
Total Workload			98
Total Workload/30(h)			10
ECTS Credit of the Course			10

PhD program, Department of Biomedical Engineering

Course Unit Title	PhD Thesis II
Course Unit Code	BME601
Type of Course Unit	Compulsory
Level of Course Unit	PhD program
National Credits	0
Number of ECTS Credits Allocated	30
Theoretical (hour/week)	Varies
Practice (hour/week)	Varies
Laboratory (hour/week)	Varies
Year of Study	2
Semester when the course unit is delivered	4
Course Coordinator	Assoc. Prof. Dr. TerinAdalı
Name of Lecturer (s) / Thesis Supervisor (s)	Depending on the Thesis Topic varies
Name of Assistant (s)	-
Mode of Delivery	Face to Face
Language of Instruction	English
Prerequisites	BME500
Recommended Optional Program Components	

Course description:

To solve biomedical problems by systems analytical thinking both in subject specific and interdisciplinary concepts. Carry out independent scientific work and organize, conduct and lead more complex projects. Each PhD student is to conduct research in the form of PhD thesis.

Objectives of the Course:

Collecting, interpreting, applying, and disseminating related data by taking social, scientific, cultural and ethical values into account.

Learning Outcomes

After completing the course, the student will be able to		Assessment
1	Develop and deepen the knowledge achieved.	2,3,4,5
2	Interpret and integrate knowledge from different disciplines and generate and analyze new information.	2,3,4,5

Assessment Methods: 1. Written Exam, 2. Assignment, 3. Project/Report, 4. Presentation, 5. Lab. Work

Course's Contribution to Program

		CL
1	Apply the rules of scientific research and ethics.	5
2	Discuss complex biomedical engineering issues as well as own research results comprehensively and in the context of current international research and present these in writing and orally.	5
3	Solve problems by systems analytical thinking both in subject specific and interdisciplinary concepts.	5
4	Combine specialized knowledge of various component disciplines.	5
5	Carry out independent scientific work and organize (capacity of teamwork), conduct and lead more complex projects.	4
6	To assess the social and environmental related effects of their actions.	5

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

Course Contents

Week	Topics	Exam
1-30	Conducting research	

Recommended Sources

Books, articles and other scientific documents related to the field

Assessment

Thesis defense: 1 0 0 %

Assessment Criteria

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

Course Policies

Governed by Graduate Education Regulations

ECTS allocated based on Student Workload

Activities	Number	Duration (hour)	Total Workload(hour)
Course duration in class (including Exam weeks)	14	2	28
Labs and Tutorials	-	-	-
Assignment	-	-	-
Project/Presentation/Report	2	20	40
E-learning activities	-	-	-
Quizzes	-	-	-
Midterm Examination	-	-	-
Final Examination	-	-	-
Self-Study	1	830	830
Total Workload			898
Total Workload/30(h)			30
ECTS Credit of the Course			30

Course Unit Title	Seminar in Biomedical Engineering
Course Unit Code	BME602
Type of Course Unit	Compulsory
Course description:	PhD Program
National Credits	-
Number of ECTS Credits Allocated	10
Theoretical (hour/week)	-
Practice (hour/week)	-
Laboratory (hour/week)	-
Year of Study	2
Semester when the course unit is delivered	4
Course Coordinator	Assoc. Prof. Dr. Terin Adalı
Name of Lecturer (s)	Depending on the thesis topic lecturer varies.
Name of Assistant (s)	-
Mode of Delivery	Face to Face
Language of Instruction	English
Prerequisites	-
Recommended Optional Program Components	

Course description:

Each PhD student is required to present his/her research findings to students and instructors. The literature review of the research and fist findings are important**.**

Objectives of the Course:

Conducting a scientific study in a field of Biomedical Engineering, and presenting this according to the scientific standards.

Learning Outcomes

	After completing the course, the student will be able to	**Assessment**
1	Carry out an independent study requiring expertise in Electrical and Electronic Engineering	3,4
2	Present current developments and research work to other students and instructors, supporting this work with qualitative	3,4

Assessment Methods: 1. Written Exam, 2. Assignment, 3. Project/Report, 4. Presentation, 5. Lab. Work

Course's Contribution to Program

		CL
1	Apply the rules of scientific research and ethics.	5
2	Discuss complex biomedical engineering issues as well as own research results comprehensively and in the context of current international research and present these in writing and orally.	5
3	Solve problems by systems analytical thinking both in subject specific and interdisciplinary concepts.	5
4	Combine specialized knowledge of various component disciplines	4
5	Carry out independent scientific work and organize (capacity to team work), conduct and lead more complex projects.	2
6	To assess the social and enviromental-related effects of their actions.	5

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

Course Contents

Week	**Topi**	**Ex**
1-32	Conducting research	

Recommended Sources

Books, articles and other scientific documents related to the field

Assessment

Research presentation 100%

Assessment Criteria Final grades are determined according to the Near East University Academic Regulations for Graduate Education
Course Policies Governed by Graduate Education Regulations

ECTS allocated based on Student Workload

Activities	Numbe	Duratio n	Total Workload(hou
Course duration in class (including Exam weeks)	14	2	28
Labs and Tutorials	-	-	-
Assignment	-	-	-
Project/Presentation/Report	3	5	15
E-learning activities	-	-	-
Quizzes	-	-	-
Midterm Examination	-	-	-
Final Examination	-	-	-
Self-Study	1	240	240
Total Workload			283
Total Workload/30(h)			9.50
ECTS Credit of the Course			10

Course Unit Title	Advance Bioinformatics
Course Unit Code	BME603
Type of Course Unit	Elective
Level of Course Unit	PhD Program
National Credits	3
Number of ECTS Credits Allocated	10
Theoretical (hour/week)	4
Practice (hour/week)	-
Laboratory (hour/week)	-
Year of Study	-
Semester when the course unit is delivered	-
Course Coordinator	Assist. Prof. Dr. Mahmut Çerkez Ergören
Name of Lecturer (s)	Assist. Prof. Dr. Mahmut Çerkez Ergören
Name of Assistant (s)	-
Mode of Delivery	Face to Face.
Language of Instruction	English
Prerequisites	-
Recommended Optional Programme Components	

Course description:

This course is graduate level bioinformatics course, which emphasizes as a basis for understanding bioinformatics and their applications. The course focuses on a general introduction to the uses of biological databases in the generating biological knowledge to better understand living systems, for purposes of aiding healing of diseases. Topics include Genomic Era, the anatomy of genome, probabilistic models of genome sequences, biological databases, sequence alignment, gene and promoter prediction, molecular phylogenetics, post-genomic epidemic, structural bioinformatics and proteomics. This course covers the fundamental concepts molecular biology, database management systems, and probabilistic models.

Objectives of the Course:

- Students will exhibit depth and breadth of knowledge by demonstrating a well-developed understanding of biological sciences.
- Student will be able to critically analyse and solve roblems in biotechnology by gathering, synthesizing and critically evaluating information from a range of sources.

Learning Outcomes

At the end of the course the student should be able to:

- Understand the theoretical basis behind bioinformatics
- Search databases accessibile on the internet for literatüre relating to molecuar biology and biotechnology.
- Manipulate DNA and protein sequences using stand-alone PC programs and programs available on the internet.
- Find homologues, analyse sequences, construct and interpret evolutionary trees.

- Anaylse protein sequences, idenfity proteins, and retrieve protein structures from databases. View and interpret these structures.
- Query biologcal data, interpret and model biological information and apply this tot he solution of biological problems in any arena involving molecular data.

		Assessment
1	Describe biological databases and how they are used.	1,2
2	How to choose an appropriate biological database for a given problem.	1, 2
3	Define bioinformatics of Genome Wide analysis.	1, 2
4	How to design and used database systems for data mining.	1, 2
5	Decide which probabilistic method is the best for sequence alignment.	1, 2
6	Apply the bioinformatics principles discussed in the design of genome comparison and pattern recognition problems.	1, 2
7	Critically review bioinformatics research studies and new technologies.	1, 2

Assessment Methods: 1. Written Exam, 2. Project/Report

Course's Contribution to Program

		CL
1	Apply the rules of scientific research and ethics	5
2	Discuss complex biomedical engineering issues as well as own research results comprehensively and in the context of current international research and present these in writing and orally	5
3	Solve problems by systems analytical thinking both in subject specific and interdisciplinary concepts	5
4	Combine specialized knowledge of various component disciplines	5
5	Carry out in dependent scientific work and organize (capacity of teamwork), Conduct and lead more complex projects	5
6	To assess the social and environment-related effects of their actions	4

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

Course Contents

Week	Chapter	Topics	Assessment

1		General Discussions and Introduction	
2		Genomic Era	1st Homework is Assigned
3		The anatomy of genome	
4		Probabilistic models of genome sequences	Projects start.
5		Introduction to Biological Databases	Assignment I (Due)
6		Sequence Alignment (All in the family)	
7		Multiple Sequence Alignment	
8		Midterm	Midterm Exam, Assignment II
9		Gene and Prometer Prediction	
10		Molecular Phylogenetics	
11		SARS-a post-genomic epidemic	
12		Structural Bioinformatics	Assignment II (Due)
13		Whole genome comparison	
14		Genomics and Proteomics	
15		Project Presentations	Project submission
16		Finals	

Recommended Sources

Textbook:

1. Jin Xiong, Essential Bioinformatics, Cambridge University Press, 2006 ISBN-13: 978-0-521-60082-8. Nello Cristianini, Matthew W. Hahn, Introduction to Computational Genomics, A Case studies Approach, Cambridge University Press, 2006, ISBN-0-521-67191-4.

Assessment

Project	30%	
Midterm Exam	30%	Written Exam
Final Exam	40%	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)	16	4 h	64
Labs and Tutorials	10	10	100
Assignment	4	3	12
Project/Presentation/Report	3	10	30
E-learning activities	-	-	-
Quizzes	-	-	-
Midterm Examination	1	5	5
Final Examination	1	3	3
Self Study	-	100	100
Total Workload			312
Total Workload/30(h)			10.1
ECTS Credit of the Course			10

BME604 –MATHEMATICAL AND COMPUTATIONAL METHODS IN BIOMECHANICS OF HUMAN	**BIOMEDICAL ENGINEEERING**

Sem	**Credit**				
	Lecture	***Practice***	***Laboratory***	***National Credits***	***ECTS***
1	4	-	-	3	10

Level of Course	**PhD program**	**Language**	English
Type of Course	ELECTIVE	**Mode of Delivery**	Face to Face

Prerequisites	**BACKGROUND lN ENGINEERING AND MATHEMATICS**
Catalog Description	Biomechanics of the human skeleton and the problem of alloarthroplasty, introduction to the anatomy of the skeletal system, total replacement of human joints, mathematical models of biomechanics, background of biomechanics, mathematical models of particular parts of the human skeleton and joints and their replacements based on boundary value problem analyses, mathematical analyses and numerical solutions of fundamental biomechanical problems, biomechanical analyses of particular parts of the human skeleton, joints, and their replacements, biomechanical models based on contact problems and biomechanical analyses of some human joints, their total replacements, and some other parts of the human skeleton.
Course Objectives	**13.** Introducing the concept of biomechanics of the human skeleton. **14.** Introducing the concept of anatomy of the skeletal system. **15.** Introducing the concept of the total replacement of human joints. **16.** Introducing the concept of the mathematical models of biomechanics, **17.** Introducing the concept of the mathematical models of particular parts of the human skeleton and joints and their replacements based on boundary value problem analyses. **18.** Introducing the concept of the mathematical analyses and numerical solutions of fundamental biomechanical problems. **19.** Introducing the concept of the biomechanical analyses of particular parts of the human skeleton, joints, and their replacements, biomechanical models based on contact problems and biomechanical analyses of some human joints, their total replacements, and some other parts of the human skeleton.
Course Outcomes	**1.** Understanding the concept of the biomechanics of the human skeleton. **2.** Understanding the anatomy of the skeletal system. **3.** Understanding the concept of the total replacement of human joints. **4.** Building mathematical models of biomechanics. **5.** Building the mathematical models of particular parts of the human skeleton and joints and their replacements based on boundary value problem analyses. **6.** Understanding the mathematical analyses and numerical solutions of fundamental biomechanical problems. **7.** Understanding the concept of the biomechanical analyses of particular parts of the human skeleton, joints, and their replacements, biomechanical models based on contact problems and biomechanical analyses of some human joints, their total replacements, and some other parts of the human skeleton.

Course Category by Content (%)	***Mathematics and Basic Sciences***	0
	Engineering	100

	Engineering Design	0
	General Education	0
Textbook and /or References	1. Jirí Nedoma, Jirí Stehlík, Ivan Hlavácek, Josef Danek, Tatjana Dostálová, and Petra Pre ˇ Cková, “. Mathematical and Computational Methods in Biomechanics of Human Skeletal Systems”, John Wiley & Sons, Inc 2. Y.C. Fung, “Biomechanics. Mechanical Properties of Living Tissues”, Springer-Verlag, 1993, New York, 2nd edition. 3. Duane Knudson, “Fundamentals of Biomechanics”, 2nd edition, Springer, 2007. 4. Ozkaya and Nordin, “Fundamentals of Biomechanics: Equilibrium, Motion, and Deformation”. 5. G.A. Holzapfel, R.W. Ogden (eds.): “Mechanics of Biological Tissue”, Springer-Verlag, 2006, Heidelberg. 6. J.D. Humphrey, S.L. Delange, “An Introduction to Biomechanics, Solids and Fluids, Analysis and Design”, Springer-Verlag, 2004, New York.	

Assessment Criteria		**Quant**	**Percentage**
	Attendance		10
	Quiz		
	Homework	1	15
	Project	1	15
	Term Paper		
	Laboratory Work		
	Other		
	Midterm Exams	1	20
	Final Exam	1	40

Student Workload	***Ac***	***Quanti***	***Duration***	***Total Workload***
	Course duration in class (including Exam weeks)	15	4	60
	Labs and Tutorials			
	Homework	4	2	8
	Project/Presentation/Report	1	1	102
	E-learning activities			
	Quizzes			
	Midterm Examination Study	1	6	6
	Final Examination Study	1	1	12
	Self Study	16	7	112
	Total Workload (hours)			300
	Total Workload / 30 (hours)			10
	ECTS Credit of the Course			10

Course Plan

Week	Topics
1	Biomechanics of the human skeleton and the problem of alloarthroplasty.
2	Introduction to the anatomy of the skeletal system.
3	Total replacement of human joints.
4	Background of biomechanics.
5	Mathematical models of particular parts of the human skeleton and joints and their replacements based on boundary value problem analyses.
6	Mathematical models of particular parts of the human skeleton and joints and their replacements based on boundary value problem analyses.
7	Mathematical analyses and numerical solutions of fundamental biomechanical problems.
8	Mid Term
9	Mathematical analyses and numerical solutions of fundamental biomechanical problems.
10	Biomechanical analyses of particular parts of the human skeleton, joints, and their replacements.
11	Biomechanical analyses of particular parts of the human skeleton, joints, and their replacements.
12	Biomechanical models based on contact problems and biomechanical analyses of some human joints, their total replacements, and some other parts of the human skeleton.
13	Biomechanical models based on contact problems and biomechanical analyses of some human joints, their total replacements, and some other parts of the human skeleton.
14	Biomechanical models based on contact problems and biomechanical analyses of some human joints, their total replacements, and some other parts of the human skeleton.
15	Final Exam

	Program Outcomes	C
i.	Adequate knowledge in mathematics, science and engineering subjects pertaining to the relevant discipline; ability to use theoretical and applied knowledge in these areas in complex engineering problems.	4
ii.	Ability to identify, formulate, and solve complex engineering problems; ability to select and apply proper analysis and modeling methods for this purpose.	4
iii.	Ability to design a complex system, process, device or product under realistic constraints and conditions, in such a way as to meet the desired result; ability to apply modern design methods for this purpose.	4
iv.	Ability to devise, select, and use modern techniques and tools needed for analyzing and solving complex problems encountered in engineering practice; ability to employ information technologies effectively.	4
v.	Ability to design and conduct experiments, gather data, analyze and interpret results forinvestigating complex engineering problems or discipline specific research questions.	4
vi.	Ability to work efficiently in intra-disciplinary and multi-disciplinary teams; ability towork individually.	4
vii.	Ability to communicate effectively in Turkish, both orally and in writing; knowledge of a minimum of one foreign language; ability to write effective reports and comprehend written reports, prepare design and production reports, make effective presentations, and give and receive clear and intelligible instructions.	4
viii.	Recognition of the need for lifelong learning; ability to access information, to follow developments in science and technology, and to continue to educate him/herself.	5
ix.	Consciousness to behave according to ethical principles and professional and ethical responsibility; knowledge on standards used in engineering practice.	4
x.	Knowledge about business life practices such as project management, risk management, and change management; awareness in entrepreneurship, innovation; knowledge about sustainable development.	4
xi.	Knowledge about the global and social effects of engineering practices on health,environment, and safety, and contemporary issues of the century reflected into the field of engineering; awareness of the legal consequences of engineering solutions.	4
C (Contribution of the course): 1: None 2: Weak, 3: Medium, 4: Strong, 5: Very Strong		

PhD program, Biomedical Engineering Department

Course Unit Title	Advanced Biomedical Image Processing
Course Unit Code	BME 605
Type of Course Unit	Elective
Level of Course Unit	PhD program
National Credits	3
Number of ECTS Credits Allocated	10
Theoretical (hour/week)	4
Practice (hour/week)	-
Laboratory (hour/week)	-
Year of Study	-
Semester when the course unit is delivered	-
Course Coordinator	Assist Prof. Dr. Kamil Dimililer
Name of Lecturer (s)	Assist. Prof. Dr. Kamil Dimililer
Name of Assistant (s)	-
Mode of Delivery	Face to Face, lab works
Language of Instruction	English
Prerequisites	-
RecommendedOptionalProgramme Components	Computer programming skills

Course description:
Advanced knowledge on diagnostic medical imaging and image processing methods are delivered to PhD students. Current "state of the art" techniques are discussed with a focus on computer aided diagnostic (CAD) imaging systems.

Objectives of the Course:

- To give the students an opportunity to study and learn advanced concepts of Image Processing.
- To implement advanced image processing methods and algorithms to solve real-life problems.
- Tounderstand CAD systems and artificial learning techniques for advanced image segmentation and recognition

Learning Outcomes
After completing the course the student will be able to;
Describe how digital images are represented, manipulated, encoded and processed with emphasis on algorithm design, implementation and performance evaluation at advance level.

		Assessment
1	Implement advance image processing techniques	2
2	Understand the theoretical aspects of image processing	1
3	Analyse and compare image processing methods	2
4	Summarize current researches in real life applications of Image Processing	3

Assessment Methods: 1. Written Exam, 2. Assignment, 3. Project/Report, 4. Presentation, 5. Lab. Work

Course's Contribution to Program

		CL
1	Apply the rules of scientific research and ethics	5
2	Discuss complex biomedical engineering issues as well as own research results comprehensively and in the context of current international research and present these in writing and orally	4
3	Solve problems by systems analytical thinking both in subject specific and interdisciplinary concepts	4
4	Combine specialized knowledge of various component disciplines	4
5	Carry out in dependent scientific work and organize (capacity of teamwork), Conduct and lead more complex projects	4
6	To assess the social and environment-related effects of their actions	4

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

Course Contents

Week	Topics	Exam
1	Overview and brief theory of diagnostic medical imaging modalities	
2	Pre-processing of medical images	
3	Image Enhancement in Spatial Domain	
4	Image Enhancement in Frequency Domain	
5	Morphological Image Processing, Edge Detection	
6	Image Restoration	
7		Midterm
8	Object Recognition	
9	Image Classification Methods	
10	Application: Detection and classification of certain anatomical structures from various medical images (MRI/CT/USG)	
11	Medical Image Segmentation	
12	Generative Models for Biomedical Image Segmentation	
13	Discriminative Techniques for Biomedical Image Segmentation	
14	Advanced artificial learning methods for fully automatic discriminative image segmentation	
15	Application: Segmentation of *multiplesclerosis* (*MS*) lessions from brain MRI images	
16		Final

Recommended Sources

1. “State of the art” workfromrecentjournalsandliterature
2. Gonzalez, Woods "Digital Image processing"
3. Gonzalez, Woods "Digital Image processing using Matlab"

Assessment		
Assignments	30%	Programming and Research
Midterm Exam	25%	Written Exam
Final Exam	45%	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. Students may use calculators during the exam.
3. Cheating and plagiarism will not be tolerated. Cheatingwill 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)	16	4	64
Labs and Tutorials	-	-	-
Assignment	-	-	-
Project/Presentation/Report	-	-	-
E-learning activities	-	-	-
Quizzes	-	-	-
Midterm Examination	1	30	30
Final Examination	1	30	30
Self Study	14	8	112
Total Workload			236
Total Workload/25(h)			9.44
ECTS Credit of the Course			10

PhD Program, Biomedical Engineering Department

Course Unit Title	Information Theory and Coding
Course Unit Code	BME606
Type of Course Unit	Elective
Level of Course Unit	PhD Program
National Credits	3
Number of ECTS Credits Allocated	10
Theoretical (hour/week)	4
Practice (hour/week)	-
Laboratory (hour/week)	-
Year of Study	-
Semester when the course unit is delivered	-
Course Coordinator	Assist.Prof.Dr. Ali Serener
Name of Lecturer (s)	Assist.Prof.Dr. Ali Serener
Name of Assistant (s)	-
Mode of Delivery	Face to Face
Language of Instruction	English
Prerequisites	-
Recommended Optional Programme Components	

Course description:

This course covers intermediate to advanced information theory and channel coding topics. Topics covered include fundamentals of channel coding as well as powerful error-correcting codes such as low-density parity-check codes and turbo codes.

Objectives of the Course:

- Study advanced information theory and modern error-correcting codes

Learning Outcomes

After completing the course the student will be able to		Assessment
1	• have a better understanding of information sources	1,2,3,4
2	• have a better understanding of how channels are modeled.	1,2,3,4
3	• understand advanced error correcting codes and their applications.	1,2,3,4

Assessment Methods: 1. Written Exam, 2. Assignment, 3. Project/Report, 4. Presentation, 5. Lab. Work

Course's Contribution to Program

		CL
1	Apply the rules of scientific research and ethics	3
2	Discuss complex biomedical engineering issues as well as own research results	
3	Solve problems by systems analytical thinking both in subject specific and	4
4	Combine specialized knowledge of various component disciplines	3
5	Carry out in dependent scientific work and organize (capacity of teamwork), Conduct	4
6	To assess the social and environment-related effects of their actions	4

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

Course Contents

Week	Topics	Exam
1	Entropy and Information, 1.1-1.10	HW #1
2	Entropy and Information, 1.11-1.21	
3	Information Channels, 2.1-2.5	
4	Information Channels, 2.6-2.10	Quız #1
5	Source Coding, 3.1-3.3	
6	Source Coding, 3.4-3.6	
7	Fundamentals of Channel Coding, 5.1-5.3	
8		Midterm
9	Fundamentals of Channel Coding, 5.4-5.7	HW #2
10	Error-Correcting Codes, 6.1-6.4	
11	Low Density Parity Check Codes, Lecture Notes	
12	Convolutional Codes, Lecture Notes	Quiz #2
13	Convolutional Codes, Lecture Notes	
14	Turbo Codes, Lecture Notes	
15		Final

Recommended Sources

1. Fundamentals of Information Theory and Coding Design, R. Togneri and C. J.S. deSilva, CRC Press.

Assessment

Assignments	25%	Programming and Research
Midterm Exam	30%	Written Exam
Final Exam	45%	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. Students may use calculators during the exam.
3. 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)	16	4	64
Labs and Tutorials	-	-	-
Assignment	2	15	30
Project/Presentation/Report	-	-	-
E-learning activities	-	-	-
Quizzes	2	10	20
Midterm Examination	1	30	30
Final Examination	1	30	30
Self Study	14	8	112
Total Workload			286
Total Workload/30(h)			9.53
ECTS Credit of the Course			10

PhD Program, Biomedical Engineering Department

Course Unit Title	Advanced Biomedical Signal-Image Processing
Course Unit Code	BME607
Type of Course Unit	Elective
Level of Course Unit	PhD Level
NationalCredits	3
Number of ECTS Credits Allocated	10
Theoretical (hour/week)	4
Practice (hour/week)	-
Laboratory (hour/week)	-
Year of Study	-
Semester when the course unit is delivered	-
Course Coordinator	Assist. Prof. Dr. Boran Şekeroğlu
Name of Lecturer (s)	Assist. Prof. Dr. Boran Şekeroğlu
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 PhD students. The purpose of the course is to provide advanced biomedical signal and image processing techniques and applications. Advanced techniques of biomedical signal-image processing, signal-image conditioning, frequency analysis, digital filtering methods, feature extraction methods, classification and learning methods and applications on EEG – ECG signals and CT-MRI images are introduced in detail. Students are provided with overviews of the major techniques that engineers have used to explore in biomedical engineering level.

Objectives of the Course:

To provide the students with an understanding of critical evaluation of scientific literature and scientific and engineering research and development in this field, as well as the skills required to present and support their findings.

Learning Outcomes

At the end of the course the student should be able to		Assessment
1	Develope a thorough understanding on basics of digital signals and biological signals.	1

2	Develope a thorough understanding on basics of medical images	1
3	Develope a thorough understanding on basics of signal pre-processing and digital filtering.	1,2
4	Develope a thorough understanding on basics of image pre-processing and image filtering.	1,2
5	Develope a thorough understanding on basics of feature extraction methods	1,2
6	Develope a thorough understanding on basics of pattern recognition and classification algorithms.	1,2
5	Learning and using MATLAB Software to apply digital filters and other digital processing methods to biomedical signals and medical images	3,4

Assessment Methods: 1. Written Exam, 2. Assignment, 3. Project/Report, 4. Presentation, 5. Lab. Work

Course's Contribution to Program

		CL
1	Apply the rules of scientific research and ethics	4
2	Discuss complex biomedical engineering issues as well as own research results comprehensively and in the context of current international research and present these in writing and orally	4
3	Solve problems by systems analytical thinking both in subject specific and interdisciplinary concepts	5
4	Combine specialized knowledge of various component disciplines	5
5	Carry out in dependent scientific work and organize (capacity of teamwork), Conduct and lead more complex projects	5
6	To assess the social and environment-related effects of their actions	4

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

Course Contents

Week	Chapter	Topics	Assessment
1		Fundamentals of biological signals	
2		Current medical imaging techniques and applications	
3		Pre-processing methods on biomedical signals	

4		Pre-processing: Applied examples on ECG and EEG signals	
5		Pre-processing methods on biomedical images	
6		Pre-processing: Applied examples on CT and MRI images	
7		Mid Term Exam	Mid Term Exam
8		Advanced biomedical signal processing methods	
9		Feature extraction in biomedical signals	
10		Pattern Recognition and classification	
11		Image Restoration- Morphological Image Processing	
12		Object Recognition and classification on medical images	
13		Image Segmentation	
14		Image Segmentation II	
15		Final Exam	Final Exam

Recommended Sources

Textbook:

1. Rafael C. Gonzalez – Richard E. Woods. Digital Image Processing.Second Edition. 2002. PrenticeHall. ISBN 0-13-094650-8.

2. Sanjit K. Mitra. DigitalSignalProcessing: A ComputerBasedApproach. Second Edition. 2002. McGrawHill. ISBN 0-07-122607-9

Lecture Notes

Assessment

Project	30%	
Midterm Exam	30%	Written Exam
Final Exam	40%	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)	16	4 h	64
Labs and Tutorials	10	10	100
Assignment	4	3	12
Project/Presentation/Report	3	10	30
E-learning activities	-	-	-
Quizzes	-	-	-
Midterm Examination	1	5	5
Final Examination	1	3	3
Self Study	-	100	100
Total Workload			320
Total Workload/30(h)			10.2
ECTS Credit of the Course			10

PhD Program, Biomedical Engineering Department

Course Unit Title	Biomaterials for Medical Diagnosis and Therapy
Course Unit Code	BME610
Type of Course Unit	Elective
Level of Course Unit	PhD Program
National Credits	3
Number of ECTS Credits Allocated	10
Theoretical (hour/week)	4
Practice (hour/week)	-
Laboratory (hour/week)	-
Year of Study	-
Semester when the course unit is delivered	-
Course Coordinator	Assoc. Prof. Dr. Terin Adalı
Name of Lecturer (s)	Assoc. Prof. Dr. Terin Adalı
Name of Assistant (s)	-
Mode of Delivery	Face to Face.
Language of Instruction	English
Prerequisites	-
Recommended Optional Programme Components	

Course description:

This course highlights the capabilities of biomaterials and devices for patient diagnostics and therapy. It is broken down into four major areas: in *vitro* and *in vivo* diagnostics (optical, electrical, mechanical), nanotechnology-enhanced analytical tools and techniques for diagnostics, and the future for patient diagnostics.

Objectives of the Course:

- Provide graduate level foundation on innovative biomaterial principles.
- Discuss concepts of surfaces & interfaces in biomedical function.
- Introduce biomimetric & rational design approaches to biomaterial engineering.
- Discuss cellular and molecular aspects of host responses to biomaterials.
- Develop critical analyses of biomaterials through grant proposal writing & review.

Learning Outcomes;

At the end of the course the student should be able to;

- Understand classes and usage area of biomaterials used in medicine
- Learns properties of biomaterials
- Explain host reactions to biomaterials and their evaluation
- Understand Tissue Engineering

		Assessment
1	Develop a thorough understanding on biomaterials used in artificial organ design and nanomedicine.	1,2
2	Develop a thorough understanding ability to nanotechnology, tissue engineering and biopharmaceutical sciences as a tool for medical diagnosis and theraphy.	1, 2

Assessment Methods: 1. Written Exam, 2. Project/Report,

Course's Contribution to Program

		CL
1	Apply the rules of scientific research and ethics	5
2	Discuss complex biomedical engineering issues as well as own research results comprehensively and in the context of current international research and present these in writing and orally	5
3	Solve problems by systems analytical thinking both in subject specific and interdisciplinary concepts	5
4	Combine specialized knowledge of various component disciplines	5
5	Carry out in dependent scientific work and organize (capacity of teamwork), Conduct and lead more complex projects	5
6	To assess the social and environment-related effects of their actions	5

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

Course Contents

Week	Chapter	Topics	Assessment
1		Introduction: Nanotechnologies for Diagnosis – Present and Future	
2		Superparamagnetic Nanoparticles for Magnetic Resonance Imaging Applications I	1st Homework Assigned
3		Superparamagnetic Nanoparticles for Magnetic Resonance Imaging Applications II	
4		Carbon Nanotube-based Vectors for Delivering Immunotherapathics and Drugs	
5		Core-Shell Nanoparticles for Drug Delivery	

6		Molecular Imaging	
7		Polymeric Nanomaterials- Synthesis, Functionalization and Applications in Diagnosis and Therapy I	
8		Midterm	Midterm Exam
9		Polymeric Nanomaterials- Synthesis, Functionalization and Applications in Diagnosis and Therapy II	2nd Homework Assigned
10		Bionanoparticles and their Biomedical Applications I	
11		Bionanoparticles and their Biomedical Applications I	
12		Intelligent Hydrogels in Nanoscale sensing	2nd Homework Due
13		Nanotechnology for Gene Therapy I	
14		Nanotechnology for Gene Therapy II	
15		Project Presentation	
16		Final	Final Exam

Recommended Sources

Textbook:

1. Challa Kumar, Nanomaterials for Medical Diagnosis and Therapy, ISBN: 978-3-527-31390-7, 2007, Wiley-VCH Verlag GmbH & Co. KGaA, Weinheim

2. Research papers on related topics

Assessment

Project	25%	
Midterm Exam	30%	Written Exam
Final Exam	45%	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	10	10	100
Assignment	-	-	-
Project/Presentation/Report	3	10	30
E-learning activities	-	-	-
Quizzes	-	-	-
Midterm Examination	1	6	6
Final Examination	1	12	12
Self Study	15	7	105
Total Workload			313
Total Workload/30(h)			10.4
ECTS Credit of the Course			10

PhD program, Biomedical Engineering Department

Course Unit Title	Magnetic Resonance Imaging
Course Unit Code	BME611
Type of Course Unit	Elective
Level of Course Unit	PhD
National Credits	3
Number of ECTS Credits Allocated	10
Theoretical (hour/week)	4
Practice (hour/week)	-
Laboratory (hour/week)	-
Year of Study	-
Semester when the course unit is delivered	-
Course Coordinator	Assist. Prof. Dr. Dilber Uzun Özşahin
Name of Lecturer (s)	Assist. Prof. Dr. Dilber Uzun Özşahin
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 PhD students. The purpose of the course is to provide detailed information on technical aspects of magnetic resonance imaging. Biomedical diagnostic magnetic resonance imaging systems and the physical principles of nuclear magnetic resonance imaging are introduced in detail. Students are provided with overviews of the major physical techniques that engineers have used to explore in biomedical engineering level.

Objectives of the Course:

To provide the students with an understanding of critical evaluation of scientific literature and scientific and engineering research and development in this field, as well as the skills required to present and support their findings.

Learning Outcomes

At the end of the course the student should be able to		Assessment
1	Develop a thorough understanding on basics of biomedical diagnostic magnetic resonance imaging devices	1
2	Develop a thorough understanding on physical principles of nuclear magnetic resonance imaging.	1, 2
3	Develop a thorough understanding on principles of MRI system electronics and instrumentations.	1, 2
4	Develop a thorough understanding on clinical applications of MRI	1, 3, 4

	modalities.	

Assessment Methods: 1. Written Exam, 2. Assignment, 3. Project/Report, 4. Presentation, 5. Lab. Work

Course's Contribution to Program

		CL
1	Apply the rules of scientific research and ethics	4
2	Discuss complex biomedical engineering issues as well as own research results comprehensively and in the context of current international research and present these in writing and orally	5
3	Solve problems by systems analytical thinking both in subject specific and interdisciplinary concepts	5
4	Combine specialized knowledge of various component disciplines	5
5	Carry out in dependent scientific work and organize (capacity of teamwork), Conduct and lead more complex projects	4
6	To assess the social and environment-related effects of their actions	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 MRI: physics and math	
2		Image formation and gradient echo	
3		Spin echo and inversion recovery MRI pulse sequences	
4		Contrast manipulation, fast imaging, artefacts	
5		MRI hardware: magnet and gradient coils	
6		MRI hardware: radiofrequency pulses and transmit and receive coils	
7		Bloch equations, high field MRI advantages and limitations	
8		Midterm	Midterm Exam
9		Basics of structural (T1, T2, FLAIR) and functional (BOLD) neuroimaging for clinical investigation	

10		Basics of hemodynamic (dynamic susceptibility contrast, arterial spin labelling and vascular space occupancy) and diffusion tensor imaging	
11		Chemical imaging, MR spectroscopy, chemical exchange, and magnetization transfer imaging	
12		Susceptibility imaging, scanner console, and analysis approaches	
13		High-field (7 Tesla) applications and clinical imaging in cerebrovascular disease	
14		Recent Developments in Medical Imaging & Revision Week	
15		FINAL EXAM	Final Exam.

Recommended Sources:

Lecture Notes.

Assessment

Project	15%	
Midterm Exam	30%	Written Exam
Final Exam	50%	Written Exam
Attendance	5%	
Total	100%	

Assessment Criteria

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

Course Policies

1. Attendancetothecourse is mandatory.
2. Lateassignmentswill not be acceptedunless an agreement is reachedwiththelecturer.
3. Studentsmayusecalculatorsduringtheexam.
4. Cheatingandplagiarismwill not be tolerated. Cheatingwill be penalizedaccordingtotheNear East University General StudentDisciplineRegulations

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	10	10	100
Assignment	-	-	-
Project/Presentation/Report	3	10	30
E-learning activities	-	-	-
Quizzes	-	-	-
Midterm Examination	1	6	6
Final Examination	1	12	12
Self Study	15	7	105
Total Workload			236
Total Workload/30(h)			9.47
ECTS Credit of the Course			10

PhD Program, Biomedical Engineering Department

Course Unit Title	Advance Artificial Organs
Course Unit Code	BME612
Type of Course Unit	Elective
Level of Course Unit	PhD Program
National Credits	3
Number of ECTS Credits Allocated	10
Theoretical (hour/week)	4
Practice (hour/week)	-
Laboratory (hour/week)	10
Year of Study	-
Semester when the course unit is delivered	-
Course Coordinator	Prof. Dr. Nesrin Hasırcı
Name of Lecturer (s)	Prof. Dr. Nesrin Hasırcı / Assoc. Prof. Dr. Terin Adalı
Name of Assistant (s)	-
Mode of Delivery	Face to Face.
Language of Instruction	English
Prerequisites	-
Recommended Optional Programme Components	-

Course description:

Medical devices that replace the function of one of the major organs in the body must usually interface with flowing blood. Examples include total artificial hearts, left ventricular assist devices, membrane oxygenators, haemodialysis systems and encapsulated endocrine cells. The design of these devices relies on integration of knowledge from a variety of fields, in particular computational fluid dynamics and blood rheology. We will study the process by which a concept for a device eventually leads to a functioning, blood-contacting medical device. An introduction to computational fluid dynamics (the finite difference and finite volume methods) will be integrated with computer-aided design and testing of devices using the software package Fluent.

Objectives of the Course:

- Important artificial organs and their design, properties and applications
- Importance of research on these areas.

Learning Outcomes;

At the end of the course the student should be able to;

- Design and understand artifical organs
- How to apply Tissue engineering principles to artifical organs
- Understand which material is suitable fort the specific design.

		Assessment
1	Explain phenomena taking place between biomaterials (implants) and surrounding tissue in living organisms.	1
2	Know process of degration of biomaterials and transport processes in synthetic membranes in artificial organs	1, 2
3	Make synthetic review of literature on new trends in biomaterials implants and artificial organs	1, 2
4	Know principles of artificial organs and their functions	1, 2

Assessment Methods: 1. Written Exam, 2. Assignment, 3. Project/Report, 4. Presentation, 5. Lab. Work

Course's Contribution to Program

		CL
1	Apply the rules of scientific research and ethics	5
2	Discuss complex biomedical engineering issues as well as own research results comprehensively and in the context of current international research and present these in writing and orally	4
3	Solve problems by systems analytical thinking both in subject specific and interdisciplinary concepts	4
4	Combine specialized knowledge of various component disciplines	3
5	Carry out in dependent scientific work and organize (capacity of teamwork), Conduct and lead more complex projects	4
6	To assess the social and environment-related effects of their actions	3

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

Course Contents

Week	Chapter	Topics	Assessment
1		Introduction	
2		Research Planning	
3		Tissue material interaction	
4		Extracorporeal devices	

5		Hemodialysis-Hemoperfusion	
6		Oxygenators	
7		Review/Exam	
8		Heart valves	
9		Artificial Total Heart	
10		Artificial Cochlea	
11		Artificial Nose	
12		Artificial Eye	
13		Review	
14			Final Exam.

Recommended Sources

Textbook: Lecture notes and research papers

Assessment

Project	15%	
Midterm Exam	30%	Written Exam
Final Exam	50%	Written Exam
Attendance	5%	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	10	10	100
Assignment	-	-	-
Project/Presentation/Report	3	10	30
E-learning activities	-	-	-
Quizzes	-	-	-
Midterm Examination	1	6	6
Final Examination	1	12	12
Self Study	15	7	105
Total Workload			313
Total Workload/30(h)			104
ECTS Credit of the Course			10

PhD program, Biomedical Engineering Department

Course Unit Title	Ultrasound Imaging and Doppler Techniques
Course Unit Code	BME618
Type of Course Unit	Elective
Level of Course Unit	PhD
National Credits	3
Number of ECTS Credits Allocated	10
Theoretical (hour/week)	4
Practice (hour/week)	-
Laboratory (hour/week)	-
Year of Study	-
Semester when the course unit is delivered	-
Course Coordinator	Assist. Prof. Dr. Deniz Bedel
Name of Lecturer (s)	Assist. Prof. Dr. Deniz Bedel
Name of Assistant (s)	-
Mode of Delivery	Face to Face.
Language of Instruction	English
Prerequisites	-
Recommended Optional Programme Components	-

Course description:

The course is designed for biomedical engineering PhD students. The purpose of the course is to provide detailed information on technical aspects of ultrasound imaging. Biomedical diagnostic ultrasound imaging systems and the physical principles of Ultrasound and Doppler techniques are introduced in detail. Students are provided with overviews of the major physical techniques that engineers have used to explore in biomedical engineering level.

Objectives of the Course:

To provide the students with an understanding of critical evaluation of scientific literature and scientific and engineering research and development in this field, as well as the skills required to present and support their findings.

Learning Outcomes

	At the end of the course the student should be able to	Assessment
1	Develop a thorough understanding on basics of biomedical diagnostic ultrasound imaging devices.	1
2	Develop a thorough understanding on physical principles of ultrasound imaging and Doppler effect.	1, 2
3	Develop a thorough understanding on principles of Ultrasound imaging system electronics and instrumentations.	1, 2

4	Develop a thorough understanding on clinical applications of Ultrasound and Doppler Ultrasound modalities.	1, 3, 4

Assessment Methods: 1. Written Exam, 2. Assignment, 3. Project/Report, 4. Presentation, 5. Lab. Work

Course's Contribution to Program

		CL
1	Apply the rules of scientific research and ethics	4
2	Discuss complex biomedical engineering issues as well as own research results comprehensively and in the context of current international research and present these in writing and orally	5
3	Solve problems by systems analytical thinking both in subject specific and interdisciplinary concepts	5
4	Combine specialized knowledge of various component disciplines	5
5	Carry out in dependent scientific work and organize (capacity of teamwork), Conduct and lead more complex projects	4
6	To assess the social and environment-related effects of their actions	3

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

Course Contents

Week	Chapter	Topics	Assessment
1		Brief history of ultrasound imaging, waves, acoustics basics, wavelength, frequency, acoustic pressure.	
2		**Acoustic wave equation:** Equation of state, conservation of mass, conservation of momentum, linear wave equation.	
3		**Plane waves:** Acoustic energy, power, intensity, solutions to the 1D wave equation, single frequency plane waves, spherical and cylindrical waves.	
4		**Scattering and absorption:** Acoustic impedance, reflection, Snell's law, scattering, acoustic attenuation, absorption, time gain compensation.	
5		**Nonlinear acoustics:** Material nonlinearity, convective nonlinearity, nonlinear propagation, wave steepening, harmonic generation, shock parameter, tissue harmonic	

		imaging.	
6		**Bubbles and bioeffects :**Ultrasound contrast agents, cavitations, radiation force, streaming, bioeffects, safety, mechanical and thermal indices.	
7		**Ultrasound transducers:** Piezoelectric generation and detection of ultrasound, piezoelectric materials, transducer frequency response, quarter wave matching layers, focused and planar transducer beam patterns, reciprocity principle.	
8		Midterm	Midterm Exam
9		**Principles of imaging:** image formation, time gain compensation, A, B and M imaging modes.	
10		**Imaging instrumentation:** B- mode scanners, linear arrays, electronic transmit and receive focusing, phased arrays, contrast, spatial resolution, image artefacts.	
11		**Doppler ultrasound:** Hemodynamics, the Doppler equation, CW and pulsed Doppler, demodulation techniques, colour Doppler, power Doppler.	
12		**Clinical applications of diagnostic ultrasound:** obstetrics, abdomen, cardiovascular, breast eye.	
13		**Hybrid optical-ultrasound imaging modalities:** Photoacoustic imaging, ultrasound modulated optical tomography.	
14		Recent Developments in Medical Imaging & Revision Week	
15		FINAL EXAM	Final Exam.

Recommended Sources

Lecture Notes.

Assessment

Project	15%	
Midterm Exam	30%	Written Exam
Final Exam	50%	Written Exam
Attendance	5%	

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	10	10	100
Assignment	-	-	-
Project/Presentation/Report	3	10	30
E-learning activities	-	-	-
Quizzes	-	-	-
Midterm Examination	1	6	6
Final Examination	1	12	12
Self Study	15	7	105
Total Workload			313
Total Workload/30(h)			10.4
ECTS Credit of the Course			10

Course Unit Title	Advance Biostatistics
Course Unit Code	BME620
Type of Course Unit	Elective
Level of Course Unit	PhD Program
National Credits	3
Number of ECTS Credits Allocated	10
Theoretical (hour/week)	4
Practice (hour/week)	-
Laboratory (hour/biweekly)	-
Year of Study	-
Semester when the course unit is delivered	-
Course Coordinator	Assoc. Prof. Dr. Evren Hıncal

Name of Lecturer (s)	Dr. Mohammed Momanzadeh
Name of Assistant (s)	
Mode of Delivery	Face to Face
Language of Instruction	English
Prerequisites	-
Recommended Optional Programme Components	-

Course description:
Within this course, students will study multivariate techniques in health care research and apply aspects of complex research designs, including model testing, decision theory, and advanced statistical techniques.

Learning Objectives
1.Identify and test assumptions for statistical tests.
2. Select, conduct and report appropriate statistics to test hypotheses with
a) One independent variable and three or more levels (aka groups): ONE-WAY ANOVA, KRUSKAL-WALLIS ANOVA
b) One independent variable and three or more levels with confounding variable (aka covariate): ANCOVA
c) One group measured repeatedly with and without covariate: REPEATED MEASURES ANOVA & ANCOVA, FRIEDMAN ANOVA
d) Two or more independent variables with 2 or more groups with and without covariate: TWO-WAY ANOVA, TWO-WAY ANCOVA aka FACTORIAL ANOVA
e) Two or more independent variables with 1 group measured repeatedly with and without covariate: TWO-WAY REPEATED MEASURES ANOVA & ANCOVA
f) Two or more independent variables and mixed methods with and without covariate: MIXED DESIGN ANOVA
g) One or more independent variables and the prediction of one or more dependent variables: REGRESSION, MULTIPLE REGRESSION, and Logistic Regression
h) Multiple Independent and Dependent Variables: MANOVA & RM MANOVA
3. Create tables to report findings.
4. Compare the utility of multivariate statistical methods in transcultural health research. 5. Interpret reported statistical findings.

Learning Outcomes

	At the end of the course the student should be able to	Assessment
1	Learn to read, critically evaluate, and discuss biostatistical primary literature	

2	Learn about a variety of statistical techniques frequently used in biology	
3	Learn to apply the techniques to real data	
4	Learn the statistical computing SPSS.	
5	Gain an understanding of how to learn new statistical techniques	
Assessment Methods: 1. Written Exam, 2. Assignment, 3. Project/Report, 4. Presentation, 5. Lab. Work		
Course's Contribution to Program		
		CL
1	Apply knowledge of mathematics, natural science with relevant to life science and multidisciplinary context of engineering science.	5

2	Analyze, design and conduct experiments, as well as to analyze and interpret data.	5
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.	4
4	Function on multidisciplinary teams.	5
5	Control in design work, by using simulation, modelling and tests and integration in a problem solving oriented way.	1
6	Display an understanding of professional and ethical responsibility.	3
7	Communicate effectively aware of the non-technical effects of engineering.	3
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	Exam
1	1	Introduction to advanced statistics	
2	1,2	Review and t-tests	
3	2	ANOVA	
4	3	ANOVA	
5	5	ANOVA	
6	5	RM ANOVA	
7	6	RM ANOVA	
8			Midterm
9	7	Correlation and Simple Regression	
10	8	Multiple Regression	
11	8	Logistic Regression	
12	9	Logistic Regression	
13	9	MANOVA	
14	13	MANOVA	
15			Final

Recommended Sources

Textbook:
None; readings will be from the primary literature (journal articles and book chapters).

Assessment

Attendance	5%	
Midterm Exam	40%	Written Exam
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. Students may use calculators during the exam.
3. 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)	16	4	64
Labs and Tutorials	10	10	100
Assignment	4	3	12
Project/Presentation/Report	3	10	30
E-learning activities	-	-	-
Quizzes	-	-	-
Midterm Examination	1	5	5
Final Examination	1	3	3
Self Study	-	100	100
Total Workload			312
Total Workload/30(h)			10.1
ECTS Credit of the Course			10

PhD Program, Biomedical Engineering Department

Course Unit Title	Clinical Engineering
Course Unit Code	BME622
Type of Course Unit	Elective
Level of Course Unit	PhD Program
National Credits	3
Number of ECTS Credits Allocated	10
Theoretical (hour/week)	4
Practice (hour/week)	-
Laboratory (hour/week)	-
Year of Study	-
Semester when the course unit is delivered	-
Course Coordinator	Assoc. Prof. Dr. Kaya Hüseyin Süer
Name of Lecturer (s)	Assoc. Prof. Dr. Kaya Hüseyin Süer
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 PhD students. Aim of the course is to provide the fundamental concepts in managing medical technology, establishing and operating a clinical engineering department and the role of the clinical engineer in designing facilities used in patient care. Topics covered included managing safety programs, technology assessment, technology acquisition, the design of clinical facilities, risk management, budgeting and ethical issues of concern to the clinical engineer.

Objectives of the Course:

To provide the students with an understanding of critical evaluation of scientific literature and scientific and engineering research and development in this field, as well as the skills required to present and support their findings.

Learning Outcomes

At the end of the course the student should be able to	Assessment

1	Develop a thorough understanding on basic concepts of clinical engineering	1,2
2	Develop a thorough understanding on the role of clinical engineers in the field.	1, 3, 4
3	Develop a thorough understanding on product safety issues of medical devices	1, 2
4	Develop a thorough understanding on management of clinical engineering departments and maintenance of medical devices in hospital and clinics	1, 2

Assessment Methods: 1. Written Exam, 2. Assignment, 3. Project/Report, 4. Presentation, 5. Lab. Work

Course's Contribution to Program

		CL
1	Apply the rules of scientific research and ethics	5
2	Discuss complex biomedical engineering issues as well as own research results comprehensively and in the context of current international research and present these in writing and orally	5
3	Solve problems by systems analytical thinking both in subject specific and interdisciplinary concepts	5
4	Combine specialized knowledge of various component disciplines	5
5	Carry out in dependent scientific work and organize (capacity of teamwork), Conduct and lead more complex projects	5
6	To assess the social and environment-related effects of their actions	5

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

Course Contents

Week	Chapter	Topics	Assessment
1		Introduction to clinical engineering	
2		Technology management	
3		Technology assessment / Technology evaluation Equipment Acquisition	
4		Service Management	

5		Codes & Standards	
6		Safety	
7		Risk Management	
8		Midterm	Midterm Exam
9		Technology Planning & Facilities Design	
10		Personnel Management	
11		Computer systems & Database Management	
12		Starting a New CE Program – In- house Dept. & Outside Service	
13		Financial Management	
14		Special Topics / Revision Week	
15		Final Exam	Final Exam

Recommended Sources:

Lecture Notes.

Assessment

Attendance	5%	Less than 25% class attendance results in NA grade
Project	15%	
Midterm Exam	30%	Written Exam
Final Exam	50%	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	10	10	100
Assignment	-	-	-
Project/Presentation/Report	3	10	30
E-learning activities	-	-	-
Quizzes	-	-	-
Midterm Examination	1	6	6
Final Examination	1	12	12
Self Study	15	7	105
Total Workload			313
Total Workload/30(h)			10.46
ECTS Credit of the Course			10

PhD Program, Biomedical Engineering Department

Course Unit Title	Pattern Recognition
Course Unit Code	BME632
Type of Course Unit	Elective
Level of Course Unit	PhD Program
National Credits	3
Number of ECTS Credits Allocated	10
Theoretical (hour/week)	4
Practice (hour/week)	-
Laboratory (hour/week)	-
Year of Study	-
Semester when the course unit is delivered	-
Course Coordinator	Assist. Prof. Dr. Boran Şekeroğlu
Name of Lecturer (s)	Assist. Prof. Dr. Boran Şekeroğlu
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 PhD students. Purpose of this course is to provide pattern recognition and classification techniques. Different event detection, feature extraction and classification methods are introduced in detail. Students are provided with overviews of the major techniques that engineers have used to explore in biomedical engineering level.

Objectives of the Course:

- To equip students, with advance mathematical and statistical techniques commonly used in pattern recognition.

- To introduce students a variety of pattern recognition algorithms, along with pointers on which algorithms work best under various conditions.
- To prepare students real World problems evaluation and solution.
- To provide a detailed overview of some advanced topics in pattern recognition and a projectopportunity to conduct independent, cutting-edge and published research.

Learning Outcomes

At the end of the course the student should be able to		Assessment
1	Develop a thorough understanding on basic event/feature detection techniques.	1, 2, 3
2	Develop a thorough understanding on principles of different feature extraction techniques.	1, 2, 3
3	Develop a thorough understanding on principles of different classification methods.	1, 2, 3

Assessment Methods: 1. Written Exam, 2. Assignment, 3. Project/Report, 4. Presentation, 5. Lab. Work

Course's Contribution to Program

		CL
1	Apply the rules of scientific research and ethics	5
2	Discuss complex biomedical engineering issues as well as own research results comprehensively and in the context of current international research and present these in writing and orally	5
3	Solve problems by systems analytical thinking both in subject specific and interdisciplinary concepts	5
4	Combine specialized knowledge of various component disciplines	5
5	Carry out in dependent scientific work and organize (capacity of teamwork), Conduct and lead more complex projects	5
6	To assess the social and environment-related effects of their actions	5

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

Course Contents

Week	Chapter	Topics	Assessment
1		Introduction to Pattern Recognition, Feature Detection, Classification	
2		Review of Probability Theory, Conditional Probability and Bayes Rules	
3		Random Vectors, Expectation, Correlation, Covariance	
4		Decision Theory, ROC Curves, Likelihood Ratio Test	
5		Linear and Quadratic Discriminants, Fisher Discriminant	
6		Template-based Recognition, Feature Extraction	
7		Eigenvector and Multilinear Analyses	
8		Midterm	Midterm Exam
9		Training Methods, Maximum Likelihood and Bayesian Parameter Estimation	
10		Support Vector Machines	
11		K-Nearest-Neighbor Classification	
12		Unsupervised Learning, Clustering, Vector Quantization, K-means	
13		Decision Trees, Multi-layer	
14		perceptron’s & Review week	
15		Final Exam	Final Exam

Recommended Sources:

Lecture Notes.

Assessment

Attendance	5%	Less than 25% class attendance results in NA grade
Project	15%	
Midterm Exam	30%	Written Exam
Final Exam	50%	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	10	10	100
Assignment	-	-	-
Project/Presentation/Report	3	10	30
E-learning activities	-	-	-
Quizzes	-	-	-
Midterm Examination	1	6	6
Final Examination	1	12	12
Self Study	15	7	105
Total Workload			313
Total Workload/30(h)			10.4
ECTS Credit of the Course			10

PhD Program, Biomedical Engineering Department

Course Unit Title	Physics in Nuclear Medicine
Course Unit Code	BME633
Type of Course Unit	Elective
Level of Course Unit	PhD Program
National Credits	3
Number of ECTS Credits Allocated	10
Theoretical (hour/week)	4
Practice (hour/week)	-
Laboratory (hour/week)	-
Year of Study	2
Semester when the course unit is delivered	1
Course Coordinator	Assist. Prof. Dr. Dilber Uzun Özşahin
Name of Lecturer (s)	Assist. Prof. Dr. Dilber Uzun Özşahin
Name of Assistant (s)	-
Mode of Delivery	Face to Face.
Language of Instruction	English
Prerequisites	
Recommended Optional Programme Components	

Course description:

Deep knowledge of conventional nuclear medicine imaging devices. Introduction of radiation detectors. Gamma camera basic principles. Field of application of gamma camera. Performance, cons and pros of gamma camera. Characterizing or evaluating image quality. Limitation of image quality, and approaches to solve it. Tomographic image reconstruction techniques. Conventional image reconstruction techniques such as Ordered Subset Expectation (OSEM) Maximization and Filtered Back Projection (FBP). Basic of Single Photon Emission Computed Tomography (SPECT) and Positron Emission Tomography (PET). State-of-the-art SPECT and PET systems.

Objectives of the Course:

1. Radiation Detectors.
2. The Gamma Camera: Basic Principles.
3. The Gamma Camera: Performance Characteristics.
4. Image Quality in Nuclear Medicine.
5. Tomographic Reconstruction in Nuclear Medicine.
6. Single Photon Emission Computed Tomography (SPECT)
7. Positron Emission Tomography (PET)

Learning Outcomes

	At the end of the course the student should be able to	Assessment
1	Understanding radiation detectors used in nuclear medicine.	1
2	Understanding the concept of the gamma camera.	1, 2,3
3	Understanding the performance of the gamma camera.	1, 2,4
4	Understanding the concept of image quality in nuclear medicine (problems, limitations and solutions)	1, 2,4

5	Understanding the problems of conventional radionuclide imaging techniques, Alternative approaches such as PET, SPECT	1,2,3
6	Understanding the concept of the SPECT	1,2,3
7	Understanding the concept of the PET	1,2,3

Assessment Methods: 1. Written Exam, 2. Assignment, 3. Project/Report, 4. Presentation, 5. Lab. Work

Course's Contribution to Program

		CL
1	Adequate knowledge in nuclear medicine imaging devices, and knowledge in these areas in complex problems.	5
2	Ability to identify, formulate, and solve complex nuclear medicine imaging tecniques problems; ability to select and apply proper modeling methods such as new scıntillator crystals or laser ınduced optical barriers techniques for this purpose.	2
3	Ability to design a complex nuclear medicine imaging device systems, process under realistic constraints and conditions, in such a way as to meet the desired result; ability to compare state of the art systems for this purpose.	1
4	Ability to devise, select, and use modern techniques and tools needed for analyzing and solving complex problems encountered in engineering practice; ability to employ information technologies effectively.	3
5	Ability to design and conduct experiments in simulation environvent, gather data, analyze and interpret results for investigating complex engineering problems or discipline specific research questions.	1
6	Ability to work efficiently in intra-disciplinary and multi-disciplinary teams; ability towork individually.	2
7	Ability to communicate effectively in Turkish, both orally and in writing; knowledge of a minimum of one foreign language; ability to write effective reports and comprehend written reports, prepare design and production reports, make effective presentations, and give and receive clear and intelligible instructions.	1
8	Recognition of the need for lifelong learning; ability to access information, to follow developments in science and technology, and to continue to educate him/herself.	1
9	Consciousness to behave according to ethical principles and professional and ethical responsibility; knowledge on standards used in nuclear medicine imaging practice.	2
10	Knowledge about basic nuclear medicine imaging devices such as PET, SPECT	2

11	Knowledge about development of new techniques to improve imagind devices performance	1

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

Course Contents

Week	Chapter	Topics	Assessment
1	7	Introduction of radiation detectors	Assignment 1
2	7	Application of radiation detectors	Assignment 2
3	13	Gamma camera basic principles	Assignment 3
4	13	Application of gamma camera in nuclear medicine	Assignment 4
5	14	Performance of Gamma camera	Assignment 5
6	14	Cons and prof of Gamma camera	Assignment 6
7			Midterm Exam
8	15	Characterizing or evaluating image quality	
9	15	Limitation of image quality, and all of the approaches to solve it	Assignment 7
10	16	Basic of Tomographic image reconstruction techniques	
11	16	Conventional image reconstruction techniques such as iterative algorithm (OSEM), and analytical method (FBP)	Assignment 8
12	17	Basic of SPECT	Assignment 9
13	17	State of the art SPECT systems, improving the performance of SPECT detectors using laser induced optical barrier technique	Assignment 10
14	18	Basic of PET, and conventional PET systems and improving the performance of PET systems	Assignment 11
15			Final Exam.

Recommended Sources

Textbook:

- **Physics in Nuclear Medicine (Fourth Edition) “ISBN: 978-1-4160-5198-5” Simon, Cheery, R.**

Supplementary Course Material

- **https://en.wikibooks.org/wiki/Basic_Physics_of_Nuclear_Medicine**

Assessment

Attendance	25%	Less than 25% class attendance results in NA grade
Assignment	5%	
Midterm Exam	25%	Written Exam
Final Exam	45%	Written Exam
Total	100%	

Assessment Criteria

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

Course Policies

- Attendance to the course is mandatory.
- Late assignments will not be accepted unless an agreement is reached with the lecturer.
- Students may use calculators during the exam.
- 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	-	-	35
Assignment	11	2	25
Project/Presentation/Report	-	-	30
E-learning activities	5	2	-
Quizzes	-	-	-
Midterm Examination	1	2	40
Final Examination	1	2	60
Self Study	15	4	50
Total Workload			300
Total Workload/30(h)			300/30
ECTS Credit of the Course			10

PhD Program, Biomedical Engineering Department

Course Unit Title	Advanced Microprocessors
Course Unit Code	BME634
Type of Course Unit	Elective
Level of Course Unit	PhD Program
National Credits	3
Number of ECTS Credits Allocated	10
Theoretical (hour/week)	4
Practice (hour/week)	-
Laboratory (hour/week)	-
Year of Study	-
Semester when the course unit is delivered	-
Course Coordinator	Assist. Prof. Dr. Kaan Uyar
Name of Lecturer (s)	Assist. Prof. Dr. Kaan Uyar
Name of Assistant (s)	-
Mode of Delivery	Face to Face.
Language of Instruction	English
Prerequisites	-
Recommended Optional Programme Components	-

Course description:

Introduction to microprocessors, Architecture of 8-bit microprocessors, PIC microcontroller code sets, Introduction to microprocessor programming, PIC16 and PIC18 series, Advance system design of microprocessors, Connections of microprocessors, memory, input-output and cutting, timing circuits.

Objectives of the Course:

In this course students will study the microcontroller hardware structure, programming and design applications.

Learning Outcomes

At the end of the course the student should be able to		Assessment
1	describe the microcontrollers and know the basics of microcontroller programming	1,2
2	design applications using microcontroller units	1,2,3,4,5
3	present group project	3,4

Assessment Methods: 1. Written Exam, 2. Assignment, 3. Project/Report, 4. Presentation, 5. Lab. Work

Course's Contribution to Program

		CL
1	Apply the rules of scientific research and ethics	3
2	Discuss complex biomedical engineering issues as well as own research results comprehensively and in the context of current international research and present these in writing and orally	3
3	Solve problems by systems analytical thinking both in subject specific and interdisciplinary concepts	3
4	Combine specialized knowledge of various component disciplines	4
5	Carry out in dependent scientific work and organize (capacity of teamwork), Conduct and lead more complex projects	5
6	To assess the social and environment-related effects of their actions	2

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

Course Contents

Week	Chapter	Topics	Assessment
1		Introduction to microcontrollers	
2		Instruction Set	
3		Instruction Set	
4		Instruction Set, Assembly program writing, Compilers	
5		Memory	
6		I/O, ADC, DAC, opamp	
7		Interrupts, Digital I/O, LCD, Timers	
8		Midterm exam	
9		Applications	
10		Applications	
11		Applications	
12		Applications	
13		Applications	
14		Applications	
15		Representations, Review	
16		Final Exam	

Recommended Sources

1. Dogan Ibrahim, "Design of a microcontroller based portable ecg unit with graphical LCD: Design of a microcontroller based ECG unit", LAP LAMBERT Academic Publishing, 2012
2. Dogan Ibrahim , Nevzat Ozyurtlu, "Design of a Microcontroller Based Uroflowmetry Device: Microcontroller Based Uroflowmetry Device Design", LAP LAMBERT Academic Publishing, 2014
3. Dogan Ibrahim, "SD Card Projects Using the PIC Microcontroller", Newnes, 2010

Assessment

Project	30%	
Assignments	20%	

Midterm Exam	20%	Written Exam
Final Exam	30%	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)	16	4	64
Labs and Tutorials	6	1	6
Assignment	2	15	30
Project/Presentation/Report	1	40	40
E-learning activities			
Quizzes			
Midterm Examination	1	16	16
Final Examination	1	28	28
Self Study	14	8	112
Total Workload			296
Total Workload/30(h)			9.87
ECTS Credit of the Course			10

PhD Program, Biomedical Engineering Department

Course Unit Title	Advanced Tissue Engineering
Course Unit Code	BME643
Type of Course Unit	Elective
Level of Course Unit	PhD Program
National Credits	3
Number of ECTS Credits Allocated	10
Theoretical (hour/week)	4
Practice (hour/week)	-
Laboratory (hour/week)	-
Year of Study	-
Semester when the course unit is delivered	-
Course Coordinator	Assoc. Prof. Dr. Terin Adalı
Name of Lecturer (s)	Prof. Dr. İsmet S. Deliloğlu
Name of Assistant (s)	-
Mode of Delivery	Face to Face.
Language of Instruction	English
Prerequisites	-
Recommended Optional Programme Components	-

Course description:

The course will cover the application of engineering principles, combined with molecular cell biology, to develop fundamental understanding of property function relationships in tissues. Exploitation of the understanding to manipulate cell and tissue properties rationally to alter, restore, maintain, or improve cell and tissue functions as well as to design bioartificial tissue substitutes.

Objectives of the Course:

To provide the students with an understanding of critical evaluation of scientific literature and scientific and engineering research and development in this field, as well as the skills required to present and support their findings.

Learning Outcomes

	At the end of the course the student should be able to	Assessment
1	Describe what is meant by the term “tissue engineering”	1
2	Explain basic principles of host response and tissue integration	1, 2
3	Give example of cell sources and cite their specific characteristics	1, 2
4	List different strategies to modify an/or design TE constructs	1, 2

5	Describe how TE constructs are fabricated and produced	
6	Explain what biodegradability is and how it affects tissue integration	
7	Describe specific applications of TE constructs	
8	Read, understand and assimilate papers, publications and lectures pertaining to the field of TE and have broad understanding of TE research.	

Assessment Methods: 1. Written Exam, 2. Assignment, 3. Project/Report, 4. Presentation, 5. Lab. Work

Course's Contribution to Program

		CL
1	Apply the rules of scientific research and ethics	5
2	Discuss complex biomedical engineering issues as well as own research results comprehensively and in the context of current international research and present these in writing and orally	2 4
3	Solve problems by systems analytical thinking both in subject specific and interdisciplinary concepts	4
4	Combine specialized knowledge of various component disciplines	4
5	Carry out in dependent scientific work and organize (capacity of teamwork), Conduct and lead more complex projects	4
6	To assess the social and environment-related effects of their actions	4

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

Course Contents

Week	Chapter	Topics	Assessment
1		Introduction	
2		Tissue Organization	
3		Tissue Dynamics/development	
4		Morphogenesis/development	
5		Stem cells/embryonic stem cells	
6		Review/ Exam	

7		Adult Stem Cells/Cell Differentiation	
8		Signalling	
9		Extracellular matrix	
10		Cell Adhesion/migration	
11		Cell-Biomaterial Integrations and Host Integration	
12		Cell source and immune response	
13		Cell and tissue culture	
14		Scale up reactor design	
15		Review	
16			Final Exam.

Recommended Sources

Textbook:

1. John P. Fisher, Antonios G. Mikos, Joseph D. Bronzino, "Tissue Engineering", CRC Press, Taylor and Francis, 2007, ISBN. 978-0-8493-9026
2. Related papers, lecture notes

Assessment

Project	30%	
Midterm Exam	30%	Written Exam
Final Exam	40%	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.
5. 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)	16	4 h	64
Labs and Tutorials	10	10	100
Assignment	4	3	12
Project/Presentation/Report	3	10	30
E-learning activities	-	-	-
Quizzes	-	-	-
Midterm Examination	1	5	5
Final Examination	1	3	3
Self Study	-	100	100
Total Workload			314
Total Workload/30(h)			10.5
ECTS Credit of the Course			10

PhD Program, Biomedical Engineering Department

Course Unit Title	Biomedical Micro and Nano Systems
Course Unit Code	BME655
Type of Course Unit	Elective
Level of Course Unit	PhD Program
National Credits	3
Number of ECTS Credits Allocated	10
Theoretical (hour/week)	4
Practice (hour/week)	-
Laboratory (hour/week)	-
Year of Study	-
Semester when the course unit is delivered	-
Course Coordinator	Assoc. Prof. Dr. Terin Adalı
Name of Lecturer (s)	Assoc. Prof. Dr. Terin Adalı
Name of Assistant (s)	-
Mode of Delivery	Face to Face.
Language of Instruction	English
Prerequisites	-
Recommended Optional Programme Components	-

Course description:

The course defines the understanding of biomedical micro and nano systems manufacturing techniques. Design, fabrication and operation issues in applications of micro-total analysis systems, drug delivery systems, devices and instrumentation for diagnosis and treatment of human disease will be presented.

Objectives of the Course:

- To comprises extensive contents and in-depth discussions on both system- and circuit-level aspects of the design of implantable microsystems.
- Discuss issues surrounding design for implantability and testability.
- Various design aspects of neural simulation microsystems, cochlear implants and visual prosthesis are reviewed.

Learning Outcomes

At the end of the course the student should be able to		Assessment
1	Apply scaling laws and advantages offered by miniaturization	1,2,3,4,5
2	Discuss the basic micro fabrication techniques for silicon, glass and polymer devices	1, 2,3,4,5
3	Analyse design, fabrication and operation of MEMS-based sensors, actuator and fluidic devices4	1, 2,3,4,5
4	Integrate interdisciplinary pri5nciples of basic sciences, medical sciences and engineering to understand biomechanical Microsystems for diagnosis and treatment of human diseases	1, 2,3,4,5
5	Apply the principles to design novel Microsystems for better health care.	1,2,3,4,5

Assessment Methods: 1. Written Exam, 2. Assignment, 3. Project/Report, 4. Presentation, 5. Lab. Work

Course's Contribution to Program

		CL
1	Apply the rules of scientific research and ethics	5
2	Discuss complex biomedical engineering issues as well as own research results comprehensively and in the context of current international research and present these in writing and orally	5
3	Solve problems by systems analytical thinking both in subject specific and interdisciplinary concepts	5
4	Combine specialized knowledge of various component disciplines	5
5	Carry out in dependent scientific work and organize (capacity of teamwork), Conduct and lead more complex projects	5
6	To assess the social and environment-related effects of their actions	5

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

Course Contents

Week	Chapter	Topics	Assessment
1		Introduction	
2		BioMEMS Materials	

3		Microfabrication Methods	
4		Microfabrication Processes	
5		Lab-on-chip or Micro Total Analysis Systems	
6		Sensing and Detection Methods	
7		Review/exam	
8		Clinical Monitoring-1	
9		Clinical Monitoring-2	
10		MEMS Implants Bioelectronics Interfaces	
11		Nano systems manufacturing techniques	
12		Review	
13			Final Exam.

Recommended Sources

Textbook:

1. Ellis Meng, BIOMEDICAL MICROSYSTEMS, CRC Press, Taylor and Francis Group, ISBN: 978-1-4200-5122-3, Lecture notes

Assessment

Attendance	5%	
Project	15%	
Midterm Exam	30%	Written Exam
Final Exam	50%	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	10	10	100
Assignment	-	-	-
Project/Presentation/Report	3	10	30
E-learning activities	-	-	-
Quizzes	-	-	-
Midterm Examination	1	6	6
Final Examination	1	12	12
Self Study	15	7	105
Total Workload			313
Total Workload/30(h)			10.4
ECTS Credit of the Course			10

PhD Program, Biomedical Engineering Department

Course Unit Title	Advance Biomechanical Cardiovascular Systems
Course Unit Code	BME660
Type of Course Unit	Elective
Level of Course Unit	PhD Program
National Credits	3
Number of ECTS Credits Allocated	10
Theoretical (hour/week)	4
Practice (hour/week)	-
Laboratory (hour/week)	-
Year of Study	-
Semester when the course unit is delivered	-
Course Coordinator	Assoc. Prof. Dr. Cenk Conkbayır
Name of Lecturer (s)	Assoc. Prof. Dr. Cenk Conkbayır
Name of Assistant (s)	-
Mode of Delivery	Face to Face.
Language of Instruction	English
Prerequisites	-
Recommended Optional Programme Components	-

Course description:

Introduction and basic concepts of biomechanics, Dynamics of mechanics, Materials properties of Hard and soft tissues, and mechanical properties, Biomechanical behaviors, Materials for prosthesis and mechanical properties, Applications and behaviors of human body, Biomechanical systems and examples.

Objectives of the Course:

Learning Outcomes

At the end of the course the student should be able to		Assessment
1	Develop a thorough understanding on cardiac mechanics and ecg systems	1,2,3
2	Develop a thorough understanding ability between the cardiology and biomedical engineering; using and developing the technology about diagnostic and treatment devices for cardiovascular diseases.	1,2,3

3	Develop a thorough understanding on the anatomy, physiology and electrophysiology of the heart and understanding the mechanism of cardiac mechanics and ECG systems.	1,2,3
4	Develop a thorough understanding of applications and behaviors of heart biomechanical systems and examples	1,2,3
5	Develop a thorough understanding materials for cardiac prosthesis and mechanical properties	1,2,3
6	Develop a thorough understanding the connections between biomedical engineering and cardiology	1,2,3

Assessment Methods: 1. Written Exam, 2. Assignment, 3. Project/Report, 4. Presentation, 5. Lab. Work

Course's Contribution to Program

		CL
1	Apply the rules of scientific research and ethics	3
2	Discuss complex biomedical engineering issues as well as own research results comprehensively and in the context of current international research and present these in writing and orally	2
3	Solve problems by systems analytical thinking both in subject specific and interdisciplinary concepts	2
4	Combine specialized knowledge of various component disciplines	2
5	Carry out in dependent scientific work and organize (capacity of teamwork), Conduct and lead more complex projects	2
6	To assess the social and environment-related effects of their actions	2

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

Course Contents

Week	Chapter	Topics	Assessment
1	1	Cardiac mechanics	
2	2	Cardiovascular system	
3	3	Cardiovascular physiology	
4	4	Modeling Cardiac Mechanics	
5	5	Applications in biomedical engineer for cardiology	
6	6	Biomechanics for cardiovascular diseases	
7	7	ECG	
8	8	ECG system portable	
9	9	Patient monitoring	
10	10	ECG Interpretation	
11	11	Mobile Wireless ECG system	
12	12	Artificial heart	
13	13	Pacemaker and leadless pacemaker	
14	14	Cardiac stem cells	

Recommended Sources

Textbook:

3. Topol. Textbook of cardiology
4. Braunwald. Textbook of cardiology
5. Seeley's principles of anatomy & physiology

Assessment

Project	%10	
Midterm Exam	%40	Written Exam
Final Exam	%50	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)	16	4	64
Labs and Tutorials	12	3	36
Assignment	2	3	6
Project/Presentation/Report	-	-	-
E-learning activities	-	-	-
Quizzes	-	-	-
Midterm Examination	1	3	3
Final Examination	1	3	3
Self Study	10	10	100
Total Workload			212
Total Workload/25(h)			9.45
ECTS Credit of the Course			10

PhD Program, Biomedical Engineering Department

Course Unit Title	Biomedical Research Methods
Course Unit Code	BME662
Type of Course Unit	Compulsory
Level of Course Unit	PhD Program
National Credits	3
Number of ECTS Credits Allocated	10
Theoretical (hour/week)	4
Practice (hour/week)	-
Laboratory (hour/week)	-
Year of Study	-
Semester when the course unit is delivered	-
Course Coordinator	Assoc. Prof. Dr. Terin Adalı
Name of Lecturer (s)	Assoc. Prof. Dr. Terin Adalı
Name of Assistant (s)	-
Mode of Delivery	Face to Face.
Language of Instruction	English
Prerequisites	-
Recommended Optional Programme Components	-

Course description:

The course defines the understanding of science and engineering and describes the links between the interrelated technical subjects. Further, it considers the methods of scientific research and focuses on the five methods mostly widely used for natural sciences and engineering, giving much emphasis on experimental and field studies research methods. It also stresses the importance of integrated research methods. It stresses the important aspects of writing research proposal, presenting and report (thesis) writing. Finally, it provides some information on research ethics and on resolving controversies in research.

Objectives of the Course:

To introduce some of the major issues in understanding of natural and technical sciences, to gain understanding of the nature of research, to make distinction among several research methods and their applications, to gain some experience in writing research proposals, to provide some skills on reporting, to encourage the class to develop their own research methods for their further studies.

Learning Outcomes		
At the end of the course the student should be able to		Assessment
1	Understand major paradigms in scientific and engineering research, their central concepts and problems.	1,2
2	Have awareness of the significant research methods within several research fields,	1, 2,3
3	Analyse scientific and pseudo- scientific texts written by the others	1, 2,3
4	Write research proposal and present it	1, 2,3
5	Contrast scientific presentation	1,2,3
6	Organize, conduct and manage scientific research with a special emphasis on ethics	1,2,3,4,
7	Improve the skills in thesis writing and dissertation.	1,2,3,4,5
Assessment Methods: 1. Written Exam, 2. Assignment, 3. Project/Report, 4. Presentation, 5. Lab. Work		

Course's Contribution to Program

		CL
1	Apply the rules of scientific research and ethics	4
2	Discuss complex biomedical engineering issues as well as own research results comprehensively and in the context of current international research and present these in writing and orally	4
3	Solve problems by systems analytical thinking both in subject specific and interdisciplinary concepts	4
4	Combine specialized knowledge of various component disciplines	3
5	Carry out in dependent scientific work and organize (capacity of teamwork), Conduct and lead more complex projects	4
6	To assess the social and environment-related effects of their actions	4

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

Course Contents

Week	Chapter	Topics	Assessment
1		Introduction	
2		Research Planning	
3		Sampling methods	
4		Research skills	
5		Experimental Design Surveys	
6		Qualitative field research	
7		Review Exam	
8		Qualitative field research	
9		Data collection	
10		Questionnaire design/ Measurement and Instrumentation	
11		Descriptive statistics	
12		Inferential statistics	
13		Review	
14		FINAL EXAM	Final Exam.

Recommended Sources

Textbook:

Lecture notes

Assessment

Project	15%	
Midterm Exam	30%	Written Exam

Final Exam	50%	Written Exam
Attendance	5%	
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	10	10	100
Assignment	-	-	-
Project/Presentation/Report	3	10	30
E-learning activities	-	-	-
Quizzes	-	-	-
Midterm Examination	1	6	6
Final Examination	1	12	12
Self Study	15	7	105
Total Workload			313
Total Workload/30(h)			10.4
ECTS Credit of the Course			10

PhD Program, Biomedical Engineering Department

Course Unit Title	Advanced Electromagnetics and Its Biomedical Applications
Course Unit Code	BME670
Type of Course Unit	Elective
Level of Course Unit	PhD program
National Credits	3
Number of ECTS Credits Allocated	10
Theoretical (hour/week)	4
Practice (hour/week)	-
Laboratory (hour/week)	-
Year of Study	
Semester when the course unit is delivered	
Course Coordinator	Assist.Prof. Dr. Refet Ramiz
Name of Lecturer (s)	Assist.Prof. Dr. Refet Ramiz
Name of Assistant (s)	-
Mode of Delivery	Face to Face,
Language of Instruction	English
Prerequisites	-
Recommended Optional Programme Components	Mathematic skills

Course description:

Coulomb’s Law, Electric Field Intensity, Electric Potential, The Field Outside an Electrically Charged Body, Gauss Law, Poisson’s Equation, Laplace’s Equation, Conductors, Calculation of the Electric Field Produced by A Simple Cahrge Distribution, Electric Dipole, The Linear Electric Quadrupole, Electric Field Outside An Arbitrary Charge Distribution, Ptential Energy of A Charge Distribution, Energy Density in an Electric Field, Forces on Conductors, Dielectric Materials, Electric Polarization, Electric Field at an Exterior Point, The Bound Charge Densities, Elrectric Field at an Interior Point, The Electric Susceptibility, Divergence of E and the Dielectric Displacement D, Relative Permittivity, Calculation of Electric Fields Involving Dielectrics, Frequency Dependence, Anisotropy and Nonhomogeneity, Potential Energy of a Charge Distribution in the Presence of Dielectrics, General Methods for Solving Laplac’s and Poisson’s Equations, Continuity of V, D,E, at the Interface Between Two Dielectric Media, Normal Component of the Electric Displacement, Tangential Component of the Electric Field Intensity, Bending of Lines of Force, The Uniqueness Theorem, Images, Point Charge Near an Infinite Grounded Conducting Plane, Solution of Laplace’s Equation in Rectangular Coordinates, Solution of Laplace’s Equation in Spherical Coordinates, Solution of Poisson’s Equation for E, Magnetic Forces, The Magnetic Induction B, The Biot Savart Law, The Force on a Point Charge Moving in a Magnetic Field, The Divergence of the Magnetic Induction B, The Vector Potential A, The Line

Integral of the A over a Closed Curve, The Curl of B, Ampere’s Circuital Law, Magnetic Dipole, Faraday Induction Law, Faraday Induction Law in Differential Form, Induced Electric Field Intensity in Terms of the Vector Potential A, Energy Stored in a Magnetic Field, Magnetic Energy in terms of B, Magnetic Energy in terms of J and A, Magnetic Energy in terms of I and Φ, Magnetic Field Intenisty H, Ampere’s Circuit Law, The Equivalent Current Density and J, Boundary Conditions, Maxwell Equations, Maxwell Equations in Integral Form, Nonhomogeneous Wave Equations for E and B, Plane Electromagnetic Waves in Free Space, Poynting Vector, The E, H Vectors in Homogeneous, Isotropic, Linear and Stationary Media, Propagation of Plane Electromagnetic Waves in Nonconductors, Propagation of Plane Electromagnetic Waves in Conducting Media, Propagation of Plane Electromagnetic Waves in Good Conductor Media, Reflection and Refraction, The Laws of Reflection and Snell’s Law of Refraction, Fresnel’s Equations, Refelction and Refraction at the Interface Between Two Nonmagnetic Nonconductors, Guided Waves, Radiation of the Electromagnetic Waves, The Vector Potential A and H, The Electric Field Intensity E, Radiation From a Half-Wave Antenna

Objectives of the Course:

- To provide a student with the necessary tools for the critical evaluation of existing and future electromagnetic and its application in biomedical phenomena
- To teach the concepts and principles of constructions of electromagnetics
- To enable a student to evaluate and choose an electromagnetic tools to match the problem

Learning Outcomes

	At the end of the course the student should be able to	Assessment
1	Use of evaluation criteria for an assessment of electromagnetic applications	1, 2
2	Demonstrate and reconstruct a specific electromagnetic problems	1, 2
3	Apply electromagnetic principles for verification of the problems	1, 2
4	Analyze variables of electromagnetic problems	1, 2
5	Examine different concepts implemented in electromagnetic problems	1, 2
6	Compare electromagnetic and biomedical problems	1, 2

Assessment Methods: 1. Written Exam, 2. Assignment, 3. Project/Report, 4. Presentation, 5. Lab. Work

Course’s Contribution to Program

		CL
1	Apply the rules of scientific research and ethics	5
2	Discuss complex biomedical engineering issues as well as own research results comprehensively and in the context of current international research and present these in writing and orally	4
3	Solve problems by systems analytical thinking both in subject specific and interdisciplinary concepts	4
4	Combine specialized knowledge of various component disciplines	4
5	Carry out in dependent scientific work and organize (capacity of teamwork),	4

	Conduct and lead more complex projects			
6	To assess the social and environment-related effects of their actions			4
CL: Contribution Level (1: Very Low, 2: Low, 3: Moderate, 4: High, 5: Very High)				
Course Contents				

Week	Chapter	Topics	Exam
1		Coulomb's Law, Electric Field Intensity Electric Potential The Field Outside an Electrically Charged Body Gauss Law Poisson's Equation	
2		Laplace's Equation Conductors Calculation of the Electric Field Produced by A Simple Charge Distribution Electric Dipole The Linear Electric Quadruple Electric Field Outside An Arbitrary Charge Distribution	
3		Potential Energy of A Charge Distribution Energy Density in an Electric Field Forces on Conductors Dielectric Materials Electric Polarization Electric Field at an Exterior Point	
4		The Bound Charge Densities Electric Field at an Interior Point The Electric Susceptibility Divergence of E and the Dielectric Displacement D Relative Permittivity Calculation of Electric Fields Involving Dielectrics	
5		Frequency Dependence, Anisotropy and Nonhomogeneity Potential Energy of a Charge Distribution in the Presence of Dielectrics General Methods for Solving Laplace's and Poisson's Equations Continuity of V, D,E, at the Interface Between Two Dielectric Media Normal Component of the Electric Displacement Tangential Component of the Electric Field Intensity	
6		Bending of Lines of Force The Uniqueness Theorem Images Point Charge Near an Infinite Grounded Conducting Plane Solution of Laplace's Equation in Rectangular Coordinates Solution of Laplace's Equation in Spherical Coordinates	
7			Midterm
8		Solution of Poisson's Equation for E Magnetic Forces The Magnetic Induction B, The Biot Savant Law	

		The Force on a Point Charge Moving in a Magnetic Field The Divergence of the Magnetic Induction B The Vector Potential A	
9		The Line Integral of the A over a Closed Curve The Curl of B Ampere’s Circuital Law Magnetic Dipole Faraday Induction Law Faraday Induction Law in Differential Form	
10		Induced Electric Field Intensity in Terms of the Vector Potential A Energy Stored in a Magnetic Field Magnetic Energy in terms of B Magnetic Energy in terms of J and A Magnetic Energy in terms of I and Φ Magnetic Field Intensity H, Ampere’s Circuit Law	
11		The Equivalent Current Density and J Boundary Conditions Maxwell Equations Maxwell Equations in Integral Form Nonhomogeneous Wave Equations for E and B Plane Electromagnetic Waves in Free Space	
12		Pointing Vector The E, H Vectors in Homogeneous, Isotropic, Linear and Stationary Media Propagation of Plane Electromagnetic Waves in Nonconductors Propagation of Plane Electromagnetic Waves in Conducting Media Propagation of Plane Electromagnetic Waves in Good Conductor Media Reflection and Refraction	
13		The Laws of Reflection and Snell’s Law of Refraction Fresnel’s Equations Reflection and Refraction at the Interface Between Two Nonmagnetic Nonconductors Guided Waves	
14		Radiation of the Electromagnetic Waves The Vector Potential A and H The Electric Field Intensity E Radiation From a Half-Wave Antenna	
15			Final

Recommended Sources

Research papers

Textbook:

Supplementary Course Material

- Edward C. Jordan, Keith G. Balmain, ELECTROMAGNETIC WAVE AND RADIATING SYSTEMS.

- John D. Kraus, Electromagnetics, Fourth Edition.
- Paul Lorrain and Dale Corson, Electromagnetic Fields and Waves, Second Edition.

Assessment

Attendance	10 %	
Assignment	%	
Midterm Exam	40 %	Written Exam
Final Exam	50 %	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	10	10	100
Assignment	-	-	-
Project/Presentation/Report	3	10	30
E-learning activities	-	-	-
Quizzes	-	-	-
Midterm Examination	1	6	6
Final Examination	1	12	12
Self Study	15	7	105
Total Workload			313
Total Workload/30(h)			10.4
ECTS Credit of the Course			10

PhD Program, Biomedical Engineering Department

Course Unit Title	Advance Artificial Neural Networks
Course Unit Code	BME680
Type of Course Unit	Elective
Level of Course Unit	PhD Program
National Credits	3
Number of ECTS Credits Allocated	10
Theoretical (hour/week)	4
Practice (hour/week)	-
Laboratory (hour/week)	-
Year of Study	-
Semester when the course unit is delivered	-
Course Coordinator	Assist. Prof. Dr. Elbrus Imanov
Name of Lecturer (s)	Assist. Prof. Dr. Kamil Dimililer
Name of Assistant (s)	-
Mode of Delivery	Face to Face
Language of Instruction	English
Prerequisites	-
Recommended Optional Programme Components	Computer programming skills

Course description:

This course explores the organization of synaptic connectivity as the basis of neural computation and learning. Perceptron and dynamical theories of recurrent networks including amplifiers, attractors, and hybrid computation are covered. Additional topics include back propagation and Hebbian learning, as well as models of perception, motor control, memory, and neural development.

Objectives of the Course:

- To give the students an opportunity to study and learn some concepts of Artificial Neural Networks
- To gain an appreciation of the principal components of Computational Intelligence
- To evaluate and implement Neural Networks for solving synthetic and real-world problems

Learning Outcomes

	After completing the course the student will be able to	Assessment
1	Explain the principles underlying Neural Networks	1
2	Understand the theoretical foundation of Neural Networks	1
3	Apply Neural Networks to find solutions to complex problems	1
4	Analyze parameter choices in the use of Neural Networks	1

5	Summarize current research in Neural Networks	1

Assessment Methods: 1. Written Exam, 2. Assignment, 3. Project/Report, 4. Presentation, 5. Lab. Work

Course's Contribution to Program

		CL
1	Apply the rules of scientific research and ethics	5
2	Discuss complex biomedical engineering issues as well as own research results comprehensively and in the context of current international research and present these in writing and orally	4
3	Solve problems by systems analytical thinking both in subject specific and interdisciplinary concepts	5
4	Combine specialized knowledge of various component disciplines	4
5	Carry out in dependent scientific work and organize (capacity of teamwork), Conduct and lead more complex projects	5
6	To assess the social and environment-related effects of their actions	5

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

Course Contents

Week	Topics	Exam
1	Introduction to Neural Networks	
2	Neural Computing	
3	Biological Neuron	
4	Definition of ANN	
5	Intelligent Computing	
6	Intelligent Computing	
7		Midterm
8	Traditional vs Neural Computing	
9	Hebbian Rule	
10	Classification on ANN	
11	Parameters of ANN	
12	XOR Problem	
13	Adaline Networks	
14	Recurrent Networks	
15	Hopfield Networks	
16		Final

Recommended Sources

1. Simon Haykin, Neural Networks, 1994.
2. Tom M. Mitchell, Machine Learning, 1997

Assessment		
Attendance/participation	10%	Less than 25% class attendance results in NA grade
Midterm Exam	40%	Written Exam
Final Exam	50%	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. Students may use calculators during the exam.
3. 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)	16	4	64
Labs and Tutorials	-	-	-
Assignment	-	-	-
Project/Presentation/Report	-	-	-
E-learning activities	-	-	-
Quizzes	-	-	-
Midterm Examination	1	30	30
Final Examination	1	30	30
Self Study	14	8	112
Total Workload			236
Total Workload/25(h)			9.54
ECTS Credit of the Course			10

Course Unit Title	Bioeffects and Therapeutic Applications of Electromagnetic Energy
Course Unit Code	BME682
Type of Course Unit	Elective
Level of Course Unit	PhD Program
National Credits	3
Number of ECTS Credits Allocated	10
Theoretical (hour/week)	4
Practice (hour/week)	-
Laboratory (hour/week)	-
Year of Study	-
Semester when the course unit is delivered	-
Course Coordinator	Assoc. Prof. Dr. Fa'eq Radwan
Name of Lecturer (s)	Assoc. Prof. Dr. Fa'eq Radwan
Name of Assistant (s)	-
Mode of Delivery	Face to Face.
Language of Instruction	English
Prerequisites	-
Recommended Optional Programme Components	Electromagnetic Theory and Mathematical skills

Course description:

Fundamental Concepts in Electromagnetic, Electromagnetic Interactions with Biological Systems, Health Risks of Electromagnetic Energy, Guidelines and Measurement for Electric and Magnetic Fields, Bioeffects of Electric and Magnetic Fields, Radio Frequency Standards and Dosimetry, Bioeffects and Health, Implications of Radio frequency Radiation, Electromagnetic Risk Analysis, Therapeutic Applications of Electromagnetic Energy, Electromagnetic Therapy. Electromagnetic Hyperthermia, Radio Frequency and Microwave Ablation, Dosimetry and Imaging, Electromagnetic and Thermal Dosimetry, Thermometry and Imaging.

Objectives of the Course:

8. Introducing the concept of electromagnetic theory and Maxwell's equations.
9. Introducing the electromagnetic fields and radiation and the interaction mechanism with biological systems.
10. Introducing the health risks of *e*lectromagnetic energy.
11. Introducing the therapeutic of *e*lectromagnetic energy.
12. Presenting the recent advances and developments in therapeutic applications of *e*lectromagnetic energy, and thermal Dosimetry, and imaging techniques.

Learning Outcomes

At the end of the course the student should be able to		Assessment
1	Learning the fundamental concepts in electromagnetic, electromagnetic interactions with biological systems.	1,2,3
2	Learning the health risks of electromagnetic energy.	1,2,3

3	Learning the applications of electromagnetic energy, electromagnetic therapy.	1,2,3
4	Learning the Thermal Dosimetry, Thermometry and Imaging.	1,2,3

Assessment Methods: 1. Written Exam, 2. Assignment, 3. Project/Report, 4. Presentation, 5. Lab. Work

Course's Contribution to Program

		CL
1	Ability to understand and apply knowledge of mathematics, science, and	3
2	An ability to analyze a problem, identify and define the computing requirements appropriate to its solution	4
3	An ability to apply mathematical foundations, algorithmic principles, and computer engineering techniques in the modeling and design of computer-based systems	4
5	An ability to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social aspects	4
6	Planning and carrying out experiments, as well as to analyze and interpret data	4
7	Ability to use the techniques, skills and modern engineering tools necessary for engineering practice	4
8	An understanding of professional, ethical, legal, security and social issues and responsibilities that apply to engineering	3
9	An ability to work productively in a multidisciplinary team, in particular to carry out projects involving computer engineering skills	3
10	An ability to communicate effectively with a range of audiences	4

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

Course Contents

Week	Chapter	Topic	Assessment
1	1	Fundamental Concepts in Electromagnetic.	
2	1	Fundamental Concepts in Electromagnetic.	
3	2	Electromagnetic Interactions with Biological	1
4	3	Health Risks of Electromagnetic Energy, Guidelines and Measurement for Electric and Magnetic Fields.	
5	4	Bioeffects of Electric and Magnetic Fields.	
6	5	Radio Frequency Standards and Dosimetry.	
7			MidTerm Exam
8	6	Bioeffects and Health Implications of Radio frequency Radiation.	
9	7	Electromagnetic Risk Analysis.	2
10	8	Electromagnetic Therapy.	
11	9	Electromagnetic Hyperthermia.	

12	10	Radio Frequency and Microwave Ablation.	3
13	11	Electromagnetic and Thermal Dosimetry.	
14	12	Thermometry and Imaging.	4
15			Final Exam

Recommended Sources Research papers
Textbook:
Supplementary Course Material

1- Habash RWY. *Electromagnetic Fields and Radiation: Human Bioeffects and Safety*. New York: Marcel Dekker, 2001.
2- Blank M, Goodman R. A biological guide for electromagnetic safety: the stress response. *Bioelectromagnetics* 2004; 25: 642–646.
3- Magnussen T. *Electromagnetic Fields*. New York: EMX Corporation, 1999.
4- Habash RWY**,** Bioeffects and Therapeutic Applications of Electromagnetic Energy, Taylor & Francis Group, 2008.
5- King RWP. The interaction of power line electromagnetic fields with the human body. *IEEE Eng Med Biol* 1998; 17: 57–78.
6- Habash RWY. *Electromagnetic Fields and Radiation: Human Bioeffects and Safety.* New York: Marcel Dekker, 2001.
7- Challis LJ. Mechanisms for interaction between RF fields and biological tissue. *Bioelectromagnetics* 2005; 25: S98–S105.
8- Byus CV, Pieper SE, Adey WR. The effects of low-energy 50 Hz environmental electromagnetic fields upon the growth-related enzyme ornithine decarboxylase. *Carcinogenesis* 1987; 8: 1385–1389.
9- Lednev VV. Possible mechanisms for the effect of weak magnetic fields on biological systems: correction of the basic expression and its consequences. In: Blank M, Editor. *Electricity and Magnetism in Biology and Medicine*. San Francisco, CA: San Francisco Press, pp. 550–552, 1999.

Assessment

Attendance	10%	Less than 25% class attendance results in NA grade
Project	30%	
Midterm Exam	20%	Written Exam
Final Exam	40%	Written Exam
Total	100%	

Assessment Criteria

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

Course Policies

5. Attendance to the course is mandatory.

6. Late assignments will not be accepted unless an agreement is reached with the lecturer.
7. Students may use calculators during the exam.
8. 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	-	-	-
Assignment	4	2	8
Project/Presentation/Report	1	102	102
E-learning activities	-	-	-
Quizzes	-	-	-
Midterm Examination	1	6	6
Final Examination	1	12	12
Self Study	16	7	112
Total Workload			300
Total Workload/30(h)			10
ECTS Credit of the Course			10

PhD Program, Biomedical Engineering Department

Course Unit Title	Modeling of Complex Biological Systems
Course Unit Code	BME690
Type of Course Unit	Elective
Level of Course Unit	PhD Program
National Credits	3
Number of ECTS Credits Allocated	10
Theoretical (hour/week)	4
Practice (hour/week)	-
Laboratory (hour/week)	-
Year of Study	-
Semester when the course unit is delivered	-
Course Coordinator	Assist. Prof. Dr. Mahmut Çerkez Ergören
Name of Lecturer (s)	Assist. Prof. Dr. Mahmut Çerkez Ergören
Name of Assistant (s)	-
Mode of Delivery	Face to Face.
Language of Instruction	English
Prerequisites	-
Recommended Optional Programme Components	

Course description:

This course introduces the current approaches for mathematical modelling and analysis of biological systems using both computer simulation and mathematical techniques. The course reviews the basic of modelling methodology, stochastic and deterministic models, numerical and analytical methods, and model validation. Examples throughout the course are drawn from population dynamics, biochemical networks, ecological models, neuronal modelling, and physiological systems.

Objectives of the Course:

- Model quantification, vertification, simplification, simulation and validation.
- Differences and possibilities of analytical and numerical models will be addressed.
- Attention will be paid to order of magnitude calculations and to the design and interpretaton of graphical representations of model simulations and eperiments, and especially to the biological significance of model and their relation with reality.

Learning Outcomes

At the end of the course the student should be able to		Assessment
1	Understand the benefits and pitfalls of mathematical modelling.	1,2

2	Design and analyse mathematical models of observed biological systems.	1, 2
3	Use existing computational tools for mathematical modelling.	1, 2
4	Analyse data obtained from complex biological systems.	1, 2
5	Perform parameter inference, model selection and evaluation	1, 2
6	Critically review theoretical systems biology research studies and new computational resources.	1, 2

Assessment Methods: 1. Written Exam, 2. Project/Report,

Course's Contribution to Program

		CL
1	Apply the rules of scientific research and ethics	5
2	Discuss complex biomedical engineering issues as well as own research results comprehensively and in the context of current international research and present these in writing and orally	5
3	Solve problems by systems analytical thinking both in subject specific and interdisciplinary concepts	5
4	Combine specialized knowledge of various component disciplines	4
5	Carry out in dependent scientific work and organize (capacity of teamwork), Conduct and lead more complex projects	5
6	To assess the social and environment-related effects of their actions	4

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

Course Contents

Week	Chapter	Topics	Assessment
1		Introduction to biochemical systems	
2		Conventions and calculations in biochemical systems Introduction to scientific programming with Python	
3		Chemical kinetics and transport processes Flow control: llops and Boolean operations	Assignment I
4		Enzyme-catalysed reactions: cycles, transients, and non-equilibrium steady-states	

		Python data types and functions	
5		Biochemical signalling modules Python classes	
6		Biochemical reaction networks File I/O and error handling	
7		Coupled biochemical systems and membrane transport Plotting with Matplotlib	
8		Midterm	Midterm Exam
9		Stochastic biochemical systems and the chemical equation I	Assignment II
10		Stochastic biochemical systems and the chemical equation II Difference and differential equations	
11		No Lecture	
12		Spatially distributed systems and reaction-diffusion modelling I Random numbers and stochastic simulation	Assignment III
13		Spatially distributed systems and reaction-diffusion modelling I Partial differential equations	
14		Constraint-based analyses of biochemical systems Linear algebra	
15		Bio macromolecular structure and molecular association Demonstration: PyMOL	
16		Finals	Project submission and Presentations

Recommended Sources

Textbook:

1. Daniel A. Beard and Hong Qian. Chemical Biophysics: Quantitative Analyses of Cellular Systems. 2008. Cambridge University Press. ISBN: 978-0-521-87070-2

2. Darren j. Wilkinson. Stochastic Modelling for Systems Biology. 2006. Chapman & Hall/CRC Mathematical & Computational Biology. ISBN: 978-1-584-88540-5

3. Hans P. Langtangen. A Primer on Scientific Programming with Pythın. 2009. Springer-Verlag. ISBN: 978-3-642-02474-0

Assessment

Project	50%	
Midterm Exam	30%	Written Exam
Coursework	%20%	
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)	16	4	64
Labs and Tutorials	-	-	-
Assignment	-	-	-
Project/Presentation/Report	-	-	-
E-learning activities	-	-	-
Quizes	-	-	-
Midterm Examination	1	30	30
Final Examination	1	30	30

Self Study	14	8	112
Total Workload			236
Total Workload/25(h)			9.54
ECTS Credit of the Course			10

PhD Program, Biomedical Engineering Department

Course Unit Title	Advanced Applied Mathematics for Engineers
Course Unit Code	MAT601
Type of Course Unit	Elective
Level of Course Unit	PhD Program
National Credits	3
Number of ECTS Credits Allocated	10
Theoretical (hour/week)	4
Practice (hour/week)	-
Laboratory (hour/week)	-
Year of Study	-
Semester when the course unit is delivered	-
Course Coordinator	Assist. Prof. Dr. Hüseyin Çamur
Name of Lecturer (s)	Assist. Prof. Dr. Hüseyin Çamur
Name of Assistant (s)	-
Mode of Delivery	Face to Face.
Language of Instruction	English
Prerequisites	-
Recommended Optional Programme Components	-

Course description:

This course aims to review of vector analysis, complex numbers, review of ordinary differential equations, variation of parameters and Cauchy-Euler differential equations, system of linear differential equations. Laplace Transforms and Fourier series, beta gamma functions, bessel2s functions and partial differential equations.

Objectives of the Course:

To provide the students with an understanding of critical evaluation of scientific literature and scientific and engineering research and development in this field, as well as the skills required to present and support their findings.

Learning Outcomes		
At the end of the course the student should be able to		Assessment
1	Apply the principles of Integral Calculus to solve a variety of practical problems in Engineering and Applied science	1
2	Express Complex Numbers in Cartesian, Polar, Trigonometric, Exponential and Logarithmic form, and use the theory of complex numbers to solve various practical problems in Engineering and Applied science	1, 2
3	Applied the theory of first and Second Order Differential Equations to solve various practical problems involving the Kinematics and Kinetics of Resisted Gravitational, Simple Harmonic and Vibratory Motion	1, 2
4	Describe and represent graphically statistical data in terms of measures of Central Tendency and measures of Dispersion	1, 2
5	Use a variety of Matrix and Numerical methods, including the use of appropriate computer software to solve Systems of Equations.	1,2
Assessment Methods: 1. Written Exam, 2. Assignment, 3. Project/Report, 4. Presentation, 5. Lab. Work		
Course's Contribution to Program		
		CL
1	Apply the rules of scientific research and ethics	3
2	Discuss complex biomedical engineering issues as well as own research results comprehensively and in the context of current international research and present these in writing and orally	2
3	Solve problems by systems analytical thinking both in subject specific and interdisciplinary concepts	2
4	Combine specialized knowledge of various component disciplines	2
5	Carry out in dependent scientific work and organize (capacity of teamwork), Conduct and lead more complex projects	2

6	To assess the social and environment-related effects of their actions	2

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

Course Contents

Week	Chapter	Topics	Assessment
1		Introduction	
2		Binary Image analysis	
3		Pattern recognition concept	
4		Filtering and enhancing images	
5		Color, shading and texture	
6		Content-based image retrieval	
7		EXAM	
8		Motion from 2 D image sequence	
9		Image segmentation	
10		Perceiving 3 D from 2 D	
11		Virtual Reality	
12		Integration of machine vision system	
13		Review	
14		FINAL EXAM	Final Exam.
15			

Recommended Sources

Textbook:

Lecture Notes

Assessment

Project	15%	
Midterm Exam	30%	Written Exam
Final Exam	50%	Written Exam
Attendance	5%	
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	10	10	100
Assignment	-	-	-
Project/Presentation/Report	-	-	-
E-learning activities	-	-	-
Quizzes	-	-	-
Midterm Examination	1	6	6
Final Examination	1	12	12
Self Study	15	7	105
Total Workload			297
Total Workload/30(h)			9.78
ECTS Credit of the Course			10