Didactic in-person course plans

Course Title: Atomic and nuclear physics

Teacher(s) name: Asra Sadat Talebi

Prerequisite(s)/Corequisite(s): -

Number of Credits: 2 **Type of Credits:** Theoretical

The number of theoretical Credit(s): 2

Academic Level of students: Master's Degree

Total Number of Sessions: 17

Course Duration: According to the academic calendar

Weekly Schedule: According to the academic calendar

Location of In-Person Sessions: Faculty of Medicine, Department of Medical Physics

Virtual Class Access Link: Lecture files/materials will be made available to the students.

Main goal of the course:

This course is designed for master's students with a background in radiology. In this course, students will become familiar with the fundamental principles of atomic and nuclear physics, with a focus on applying these concepts in medical applications.

Learning Objectives:

Upon successful completion of this course, students will be able to:

- Familiarity with the atomic theory of matter and electricity
- Understanding the atomic model
- Understanding the theory of atomic radiation
- Familiarity with blackbody radiation laws and the Stefan–Boltzmann relations
- Understanding the wave-particle duality theory
- Familiarity with Heisenberg's uncertainty principles and related problems
- Understanding multi-electron atoms
- Introduction to quantum physics

- Familiarity with the fundamental concepts of the nucleus and nuclear models
- Understanding nuclear reactions and their applications in medicine
- Familiarity with the interactions and collisions of radiation with matter
- Understanding nuclear fission and fusion and the applications of medical accelerators

Teaching Strategies/ methods:

The teaching process in this course is conducted using a video projector, whiteboard, PowerPoint presentations, interactive learning systems, lectures, and question-and-answer sessions.

Assessment and Evaluation Methods:

Midterm exam: 4 points, Final exam: 15 points, Regular class attendance and completion of assignments: 1 point

Minimum Passing Grade: 14

Maximum Permitted Absences: 4

Core Educational References:

- Modern Physics – Kenneth S. Krane
- Fundamentals of Nuclear Physics – Walter Meyerhof

Supplementary Learning Opportunities:

To enhance the theoretical and practical knowledge of students, the following supplementary learning opportunities are provided:

- Specialized medical physics workshops held throughout the year.
- Scientific congresses in medical physics to familiarize students with the latest scientific and research achievements.
- Educational and specialized webinars offered by the Department of Medical Physics, providing easier access to modern topics and facilitating scientific interaction in a virtual environment.

Contact Information:

- Teacher(s): Asra Sadat Talebi, Email: asra.talebi@yahoo.com
- Educational Program Coordinator: Asra Sadat Talebi, Email: asra.talebi@yahoo.com
- Educational staff: Asra Sadat Talebi, Email: asra.talebi@yahoo.com

In the name of God

Course guide: Electricity and Magnetism and its applications in medicine

Instructor: Akram Mahna

Prerequisite or concurrent unit: None

Number of units: 1 - Unit type: 1. Theoretical unit - Level: Master's degree

Number of sessions: 8

Start and end dates of sessions: In accordance with educational regulations

Time of sessions per week: In accordance with educational program

Location of in-person sessions: Medical Physics Department

Overall goal and course introduction:

Familiarization of students with cellular electrical potentials, familiarization with types and methods of recording body electrical signals, familiarization with bioelectrodes, familiarization with bioamplifiers, familiarization with high-frequency currents and their applications.

Educational objectives of the course unit

Sessions	General objectives	Specific objectives: concepts that the student should become familiar with
First and second	Familiarity with cellular potentials	- An introduction to the applications of physics in medicine - Derivation of the resting potential formula and Nernst equation - Familiarity with the mechanisms of material transport into and out of the cell - Definition of cellular active potentials - Familiarity with neurons
Third	Learning about types of bio–potential recording electrodes	- Types of external bioelectrodes - Types of internal bioelectrodes
Fourth	Introduction to bioamplifiers	- Familiarity with the features and applications of bioamplifiers - Introduction to pre–bioamplifiers
Fifth	Learning how to record bio–potential signals	- Familiarity with ECG signals and how to record them - Familiarity with EEG signals and how to record them
Sixth	Learning how to record bio–potential signals	- Familiarity with EMG signals and how to record them - Familiarity with ERG signals and how to record them
Seventh	EPS - evoked potentials and brain biomagnetism	- Characteristics of evoked potentials - VEP - SSEP - BAER - Recording and averaging method - Magnetometer

		- Magnetoencephalogram **- MSI**
Eighth	**Methods for measuring intrinsic properties of biological tissues**	**- Plethysmography** **- Impedance meter** **- Impedance tomography** **- Electrodermal responses**

Teaching method

Video projector - whiteboard - PowerPoint - lecture - Q&A

Student assessment method

Class participation each session, assignment submission to students - written exam in multiple-choice and descriptive format at the end of term

40% midterm, 60% final exam

Minimum passing grade for this course: based on the curriculum

Allowed number of absence hours for this course: according to approved educational regulations

Educational resources

1. Bioelectromagnetism (Principles and Applications of Bioelectric and Biomagnetic Fields) by Jaakko Malmivuo and Robert Plonsey

2. Medical Equipment Design and Application by John Webster, translated by Siamak Najarian

Educational resources for further study

1. Bioelectrics by Dr. Ahmad Shanei

Learning opportunities

Internet – related articles

Contact information

Instructor of the course:phone, email, etc

,Akram Mahna , 04133364660

akram.mahna@gmail.com

Educational specialist : (phone, email, etc)

,Leila Ghanbari04133364660

Didactic in-person course plans

Course Title: Light and Visual Physics

Teacher(s) name: Dr.hossein Rasta

Prerequisite(s)/Corequisite(s): -

Number of Credits: 1 **Type of Credits:** Theoretical and practical

The number of theoretical Credit(s): 0.5 **The number of practical Credit (s):**0.5

Academic Level of students: Master's Degree

Total Number of Sessions: 8

Course Duration: According to the academic calendar

Weekly Schedule: According to the academic calendar

Location of In-Person Sessions: Faculty of Medicine, Department of Medical Physics

Virtual Class Access Link: Lecture files/materials will be made available to the students.

Main goal of the course:

Enhancing students' knowledge and skills in the physics of the eye, refractive errors, and optometry, so that graduates of this field acquire the necessary competence to teach these topics to students of basic medical sciences and optometry.

Learning Objectives:

Upon successful completion of this course, students will be able to:

- Explain the types of spherical and cylindrical lenses.
- Describe the methods for combining spherical and cylindrical lenses.
- Determine point and line images in spherical, cylindrical, and combined lens systems.
- Identify spherical and astigmatic aberrations and apply methods for their correction.
- Explain the causes of diplopia (double vision) and the methods for its correction.
- Describe the physics of preparing visual acuity charts.
- Measure visual acuity.

- Determine the visual field.
- Explain the direct and indirect ophthalmoscopy techniques.
- Observe the fundus of the eye.
- Explain color vision disorders.

Teaching Strategies/ methods:

The teaching process in this course is conducted using a video projector, whiteboard, PowerPoint presentations, interactive learning systems, lectures, and question-and-answer sessions.

Assessment and Evaluation Methods:

Class Participation: Active participation in each session(1 point).

Assignments: Submission of assigned homework and tasks (3 points).

Final Exam: Written exam at the end of the term, including multiple-choice and descriptive questions (16 points).

Minimum Passing Grade: 14

Maximum Permitted Absences: 2

Core Educational References:

DUKE-ELDER'S "Practice of Refraction" by Abram David, 9th ed. Churchill Livingston,1978. UK.
Medical Physics – John R. Cameron

Supplementary Learning Opportunities:

To enhance the theoretical and practical knowledge of students, the following supplementary learning opportunities are provided:

- Specialized medical physics workshops held throughout the year.
- Scientific congresses in medical physics to familiarize students with the latest scientific and research achievements.
- Educational and specialized webinars offered by the Department of Medical Physics, providing easier access to modern topics and facilitating scientific interaction in a virtual environment.

Contact Information:

- Teacher(s): Dr Hossein Rasta, **04133364660**

Didactic in-person course plans

Course Title: Physics of Diagnostic Radiology

Teacher(s) name: Tohid Mortazazadeh

Prerequisite(s)/Corequisite(s): -

Number of Credits: 2 **Type of Credits:** Theoretical

The number of theoretical Credit(s): 2

Academic Level of students: Master's Degree

Total Number of Sessions: 17

Course Duration: According to the academic calendar

Weekly Schedule: According to the academic calendar

Location of In-Person Sessions: Faculty of Medicine, Department of Medical Physics

Virtual Class Access Link: Lecture files/materials will be made available to the students.

Main goal of the course:

This course is designed for M.Sc. students in Medical Physics. In this course, students will become familiar with the fundamental principles and basic concepts of diagnostic radiology. They will learn about image formation, factors affecting image quality, and basic image processing techniques to improve image quality across different medical imaging modalities.

Learning Objectives:

Upon successful completion of this course, students will be able to:

- Understand the **physical principles of X-ray production**.
- Explain the **interaction of X-rays with tissues** and the concept of **attenuation coefficients**.
- Describe **radiation contrast**, methods to improve it, and strategies to control **scatter radiation**.
- Identify different types of **diaphragms and filters** and evaluate their effects on image quality.
- Understand various **radiographic films** and their **development and fixation processes**.
- Describe the **photographic properties of radiographic films**.

- Explain the **structure and function of intensifying screens**.
- Recognize the factors causing **image blurring** and methods to reduce it.
- Identify **image artifacts** and understand the factors influencing their appearance.
- Understand the principles of **fluoroscopy**.
- Evaluate **image quality in fluoroscopy**, factors affecting it, and patient **exposure and dose**.
- Describe the design and operation of **mammography systems**.
- Understand the principles and **quality considerations in mammographic imaging**.

Teaching Strategies/ methods:

The teaching process in this course is conducted using a video projector, whiteboard, PowerPoint presentations, interactive learning systems, lectures, and question-and-answer sessions.

Assessment and Evaluation Methods:

Midterm exam: 4 points, Final exam: 15 points, Regular class attendance and completion of assignments: 1 point

Minimum Passing Grade: 14

Maximum Permitted Absences: 4

Core Educational References:

- The Essential Physics of Medical Imaging by Jerrold T. Bushberg
- Christensen's Introduction to the Physics of Radiology by James E. Dowdey and Thomas S. Curry

Supplementary Learning Opportunities:

To enhance the theoretical and practical knowledge of students, the following supplementary learning opportunities are provided:

- Specialized medical physics workshops held throughout the year.

- Scientific congresses in medical physics to familiarize students with the latest scientific and research achievements.
- Educational and specialized webinars offered by the Department of Medical Physics, providing easier access to modern topics and facilitating scientific interaction in a virtual environment.

Contact Information:

- Teacher(s): Tohid Mortazazadeh , **tmortezazadeh@tbzmed.ac.ir**