FBEAE 205 - PHYSICS 3 - Eğitim Fakültesi - Matematik ve Fen Bilimleri Eğitimi Bölümü

General Info

Objectives of the Course

This course aims to enable prospective teachers to grasp the basic information about thermodynamics, optics, waves, relativity theory, atomic models, introduction to modern physics, etc. and to relate them to current life and the teaching profession.

Course Contents

Heat and temperature, thermal properties of matter, laws of thermodynamics, reversible and irreversible events, efficiency and entropy; structure, speed and sources of light; reflection and mirrors; refraction and lenses; interference, thin films, diffraction, resolution, polarization; optical instruments, magnifying glass, glasses, microscope, etc.; wave motion, kinematics, dynamics, energy, reflection, refraction and interference, sound waves, standing waves, resonance, sound intensity, Doppler phenomenon; Atom models, energy levels, atomic and molecular spectra; relativity; black body radiation, photoelectric and Compton effect; wave-particle dilemma, De Broglie waves, Heisenberg Uncertainty principle, Schrödinger wave.

Recommended or Required Reading

1) Fizik 3, Editör: Prof. Dr. Hakan Şevki Aydın, Pegem Akademi, 2019.
2) Fizik 3: Problem Çözümleri, Prof. Dr. Hakan Şevki Aydın, Pegem Akademi, 2019.
3) Karaoğlu B. (2017). Üniversiteler için Fizik. Seçkin Yayıncılık
4) Serway, Raymond A., and Beichner, Robert J. (2000). Fen ve Mühendislik için Fizik III.
 5) Chown, M. (2009), Biraz Kuantumdan zarar gelmez, İstanbul, Alfa Yayıncılık.

Planned Learning Activities and Teaching Methods

Question and answer, experimentation, demonstration experiment, problem solving, lecture

Recommended Optional Programme Components

Before coming to class, the suggestions in the preparation section should be followed for preparation and for review after class.

Instructor's Assistants

There is no teaching assistant teaching the course.

Presentation Of Course

Face-to face

Dersi Veren Öğretim Elemanları

Prof. Dr. Şeyma Akkaya Deviren

Program Outcomes

1. Can relates the basic concepts of heat and temperature with daily life.
2. Can anallyze the movement of waves in different structure
3. Can explain the similarities and differences between classical physics and modern physics.
4. Can explain the atomic models
5. Can solve problems involving the Photoelectric and Compton Effects.
6. Question thermodynamic applications using the laws of thermodynamics
7. Knows the basic concepts and principles of geometric optics.
8. Evaluates the role of special relativity in everyday life and modern technologies (GPS systems, particle accelerators, etc.).

Weekly Contents

Order	PreparationInfo	Laboratory	TeachingMethods	Theoretical	Practise
1	Pages 2-8 of the "Physics 3" book should be read, covering topics such as temperature and the zeroth law of thermodynamics, temperature measurement and thermometers, thermal expansion, and ideal gases. To reinforce the lesson, the first five problems in the problem solutions section of Chapter 1 of the "Physics 3 Problem Solutions" book should be solved.		Demonstration experiment, question-answer, problem solving	Basic concepts related to temperature and the zeroth law of thermodynamics, temperature measurement and thermometers, thermal expansion and ideal gases will be given and the necessary equations will be obtained.	The working principle of thermometers will be demonstrated in practice and problems related to temperature measurement and ideal gases will be solved.

Order	PreparationInfo	Laboratory	TeachingMethods	Theoretical	Practise
2	"Fizik 3" adlı ders kitabının sayfa 12- 29 arasındaki "ısı ve iç enerji, ısı sığası, özgül ısı ve hal değiştirme ısısı, ısının aktarılması, tersinir ve tersinmez süreçler, Termodinamiğin 1. Kanunu ve Termodinamiğin 1. Kanununun bazı uygulamaları" adlı konu başlıkları okunmalı. Dersi pekiştirmek için "Fizik 3 Problem Çözümleri" kitabının 1. bölümdeki problem çözümleri kısmındaki problemlerden 6- 24 e kadar olan problemler çözülmeli.		Question-answer, problem solving	Isı ve iç enerji, ısı sığası özgül ısı ve hal değiştirme ısısı kavramları verilerek ısının aktarılması, tersinir tersinmez süreçler ve Termodinamiğin 1. Kanunu tanımlanarak denklemleri elde edilecek.	Termodinamiğin 1. Kanununun uygulamaları yapılacak
3	The topics "2nd law of thermodynamics, Carnot engine and Carnot cycle, Clausius inequality and entropy, 3rd law of thermodynamics" should be read from page 30 to page 30 of the book "Physics 3". To reinforce the lesson, problems 25-29 in the problem solutions section of Chapter 1 of the book "Physics 3 Problem Solutions" should be solved.		Problem solving, explanation, question and answer	After presenting the Second Law of Thermodynamics, the Carnot engine and the Carnot cycle will be derived. The Nerst Principle, also known as the Third Law of Thermodynamics, will be discussed.	Carnot cycle and efficiency calculations will be made.
4	The topics "structure of light, light sources, propagation of light, shadow and shadow phenomena, reflection of light, reflection phenomena, plane mirrors" should be read on pages 105-119 of the book "Physics 3". To reinforce the lesson, the first 7 problems in the problem solutions section of Chapter 3 of the book "Physics 3 Problem Solutions" should be solved.		Demonstration experiment, question-answer, observation	The structure of light, along with natural and artificial light sources, will be discussed. The phenomena of light propagation, shadow, and shadow will be discussed, along with the reflection of light, the law of reflection, plane mirrors, image formation in plane mirrors, and field of view.	Image formation in plane mirrors will be drawn, and the principle of solar and lunar eclipses will be given as a demonstration experiment.
5	The topics "spherical mirrors, concave mirrors, special rays in concave mirrors, image formation in concave mirrors, convex mirrors, special rays in concave mirrors, image formation in convex mirrors, magnification ratio in convex mirrors" should be read on pages 120-127 of the book "Physics 3". To reinforce the lesson, problems numbered 8-14 in the problem solutions section of chapter 3 of the book "Physics 3 Problem Solutions" should be solved.	Images of objects at different points will be obtained with spherical mirrors.	Question and answer, drawing, demonstration experiment.	Concepts related to spherical mirrors, properties of concave and convex mirrors, image drawing in spherical mirrors, magnification ratio in spherical mirrors will be given and their applications in daily life will be done.	Obtaining images from spherical mirrors.
6	The following topics should be read between pages 127-144 of the book "Physics 3": "Laws of refraction, light prisms, colors of light, concave lenses, special rays in concave lenses, drawing images in concave lenses, concave lens formulas, concave lenses, drawing images in concave lenses, concave lens formulas." To reinforce the lesson, problems numbered 15-25 in the problem solutions section of chapter 3 of the book "Physics 3 Problem Solutions" should be solved.		Question and answer, problem solving, explanation.	Refraction of light, the laws of refraction, the index of refraction will be given, light prisms, light colors will be discussed, concave and concave lenses will be introduced and images and their properties will be obtained with these lenses.	Images from concave and concave lenses will be obtained through drawing and practice.

Order	PreparationInfo	Laboratory	TeachingMethods	Theoretical	Practise
7	The topics "Wave formation and wave types, transverse waves, longitudinal waves, earthquake waves, wave function, propagating periodic waves, function of periodic waves, reflection and transmission of waves, energy of waves" should be studied between pages 48-73 of the "Physics 3" textbook. To repeat the course, the first 9 problems in section 2, page 11, of the "Physics 3 Problem Solutions" book should be solved.	Experiments examining the properties of water waves will be conducted in the wave basin.	Experimenting, question-answer, explanation	To provide a detailed understanding of wave motion, the concepts of wave crest or trough, wave amplitude, wavelength, and wave speed will be introduced. Wave formation and wave types will be discussed, and the mathematical expression of propagating periodic waves will be derived. Furthermore, reflection and transmission of waves will be presented, and wave energy will be calculated. Interference and reflection in water waves will be demonstrated through an experiment in a wave basin.	
8				midterm exam	
9	The topics "Relative motion and inertial reference systems, the Michelson-Morley experiment, postulates of special relativity, space-time, time dilation, the twins paradox, mass, energy, E=mc2" should be studied between pages 215-237 of the "Physics 3" textbook. To review the course, the first 16 solved problems in chapter 7, page 79 of the "Physics 3 problem solutions" book should be reviewed.		Question and answer, narration, case study	Relativity, motion, and inertial reference systems will be examined. The Michelson-Morley experiment and its results will be discussed. Postulates of special relativity: simultaneity, space-time, and time relativity-time dilation will be presented. The Gemini paradox will be discussed. Einstein's thought experiment will be used to provide solutions to problems related to length relativity-time dilation and length contraction. Lorentz transformations, relativistic momentum, mass, energy, and the E=mc2 equation will be discussed in detail.	The concept of synchronicity will be introduced through a case study. The film "Interstellar" will be watched and concepts such as time dilation and length contraction will be discussed.
10	he topics titled "Introduction to modern physics, black body radiation and Planck theory, Wien-displacement law, Rayleigh-Jeans law" should be read from the "Physics 3" textbook, pages 247-255. Additionally, the following resources are recommended. 1) Weatherall, J. O. (2017). Boşluk: Hiçliğin tuhaf fiziği, Ankara Buzdağ Yayınevi. 2) Chown, M. (2009), Biraz Kuantumdan zarar gelmez, İstanbul, Alfa Yayıncılık.		Problem solving, understanding, question and answer.	The differences between modern and classical physics will be revealed. The duality of light, that is, its particle and wave properties, will be discussed. Black bodies and black body radiation will be presented. Planck's explanation of black body radiation will be presented, and the definitions of photons and quanta will be discussed.	Problem solutions related to black body radiation will be made.
11	The topic titled "Photoelectric Effect" should be read between pages 255-260 of the "Physics 3" textbook. The first 8 solved problems between pages 93-96 of the "Physics 3 Problem Solutions" book should be examined.		Problem solving, question-answer, explanation.	The photoelectric effect and the results of the experiment will be discussed in the context of classical and modern physics. The equations for the photoelectric effect will be derived and related problems will be solved.	Problem solutions related to the photoelectric effect will be done as an application.
12	In the "Physics 3" textbook, read the topic titled "Compton Effect" on page 260, and examine the 9th and 10th solved problems, which will help you understand the Compton shift equation on page 97 of the "Physics 3 Problem Solutions" textbook. The following resource will also be useful for understanding this unit: Klein, E., A Short Trip in the Quantum World (2018), Istanbul Bgst Publications		Problem solving, explanation.	Compton Scattering and the Compton shift equation will be given and related problems will be solved. X-rays and their properties will be discussed.	Problem solutions related to Compton scattering will be made

Order	PreparationInfo	Laboratory	TeachingMethods	Theoretical	Practise
13	In the "Physics 3" textbook, the topics titled "Wave-particle duality, De Broglie waves, Heisenberg Uncertainty Principle" on page 265 should be read, and solved problems numbered 11-14 on pages 98-100 of the "Physics 3 Problem Solutions" book should be examined. It is also recommended to read the following resource: Fritzch, H. You're Wrong, Einstein! Newton, Einstein, Heisenberg, and Feynman Discuss Quantum Physics (2104) Istanbul, Metis Publishing.		Lecture, question-answer, problem solving	Wave-particle duality and De-Broglie waves will be introduced. The Heisenberg uncertainty principle will be discussed and related problems will be solved.	Problems related to De-Broglie waves and the Heisenberg uncertainty principle will be solved.
14	In the "Physics 3" textbook, the topics titled "Atom and matter, atomic size, electrical structure of atoms, specific charge of the electron, charge of the electron: Milikan Experiment, light spectrum, line spectra" on pages 192-206 should be read. It is also recommended to read the following source: Electron structure of the atom, Hasan N. Erten, Namık K. Tunalı, METU Faculty of Science Publications, Ankara, 1977.		Question-answer lecture.	Explanations will be given on the concepts of atoms and matter. Atomic size, the electrical structure of atoms, and the charge of the electron will be discussed. Measurement of electric charge: The Millikan Experiment will be discussed. Electromagnetic waves, light spectra, and line spectra will be interpreted.	An application will be made on the Milikan Oil drop experiment.
15	In the textbook titled "Physics 3", the topics titled "Thompson atomic model, Rutherford scattering experiment: Rutherford atomic model, Bohr atomic model, radii of Bohr orbits" between pages 199-212 should be read and the solved problems in chapter 6, pages 71-78 of the book titled "Physics 3 Problem Solutions" should be examined.		Question and answer, discussion, lecture	Atomic models will be discussed. The Thomson atomic model, the Rutherford scattering experiment, and the resulting Rutherford atomic model will be discussed. The postulates, successes, and shortcomings of the Bohr atomic model, proposed through modern physics, will be presented, and the radii of the Bohr orbits will be calculated.	A small model of the Thomson atomic model will be made.

Workload

Activities	Number	PLEASE SELECT TWO DISTINCT LANGUAGES
Vize	1	1,00
Final	1	1,00
Ders Öncesi Bireysel Çalışma	14	1,00
Ders Sonrası Bireysel Çalışma	14	2,00
Ara Sınav Hazırlık	4	4,00
Final Sınavı Hazırlık	4	4,00
Bütünleme	1	1,00
Derse Katılım	1	10,00

Assesments

Activities	Weight (%)
Ara Sınav	40,00
Final	60,00

Fen Bilgisi Eğitimi Ana Bilim Dalı / FEN BİLGİSİ ÖĞRETMENLİĞİ X Learning Outcome Relation

	P.O. 1	P.O. 2	P.O. 3	P.O. 4	P.O. 5	P.O. 6	P.O. 7	P.O. 8	P.O. 9	P.O. 10	P.O. 11	P.O. 12	P.O. 13	P.O. 14	P.O. 15	P.O. 16	P.O. 17	P.O. 18	P.O. 19	P.O. 20	P.O. 21	P.O. 22	P.O. 23	P.O. 24	P.O. 25
L.O. 1			5	5													5								
L.O. 2			5	5																					

	P.O. 1	P.O. 2	P.O. 3	P.O. 4	P.O. 5	P.O. 6	P.O. 7	P.O. 8	P.O. 9	P.O. 10	P.O. 11	P.O. 12	P.O. 13	P.O. 14	P.O. 15	P.O. 16	P.O. 17	P.O. 18	P.O. 19	P.O. 20	P.O. 21	P.O. 22	P.O. 23	P.O. 24	P.O. 25
L.O. 3			5	5																					
L.O. 4			5	5													5								
L.O. 5			5	5													5								
L.O. 6			5	5																					
L.O. 7			5	5													5								
L.O. 8			5	5													5								

Table :

P.O. 1 : Alanı ile ilgili öğretim programları, öğretim strateji, yöntem ve teknikleri ile ölçme ve değerlendirme bilgisine sahiptir.

P.O. 2 : Bilginin doğası, kaynağı, sınırları, doğruluğu, güvenirliliği ve geçerliğinin değerlendirilmesi konusunda bilgi sahibidir.

P.O. 3 : Öğrencilerin ihtiyaçlarını karşılayabilecek düzeyde Fen ve teknoloji dersi alan (Fizik, kimya, biyoloji, yer bilimleri vb.) bilgisine sahiptir.

P.O. 4 : Alanıyla ilgili olay ve olguları kavramsallaştırır, bilimsel yöntem ve teknikleri kullanarak problemleri çözer.

P.O. 5 : Öğrencilerin gelişim özelliklerini, bireysel farklılıklarını; konu alanının özelliklerini ve kazanımlarını dikkate alarak en uygun öğretim strateji, yöntem ve tekniklerini uygular.

P.O. 6 : Milli Eğitim Bakanlığı tarafından hazırlanan Fen Bilimleri Dersi Öğretim Programının özelliklerini bilir ve programı etkin bir şekilde uygular.

P.O. 7 : Konu alanına ve öğrencinin gereksinimlerine uygun materyal geliştirir.

P.O. 8 : Öğrencinin kazanımlarını farklı teknik ve yöntemler kullanarak çok yönlü değerlendirir.

P.O. 9 : Laboratuvar deneyleri ve etkinlikleri ile ilgili bilgi ve becerileri meslek hayatında uygular.

P.O. 10 : Bireysel ve grup çalışmalarında sorumluluk alır ve alınan görevi etkin bir şekilde yerine getirir.

P.O. 11 : Kendini bir birey olarak tanır; yaratıcı ve güçlü yönlerini kullanır ve zayıf yönlerini geliştirir.

P.O. 12 : Edindiği bilgi ve becerileri eleştirel bir yaklaşımla değerlendirir.

P.O. 13 : Bilgiye ulaşma yollarını etkin bir şekilde kullanır.

P.O. 14 : Düşüncelerini ve sorunlara ilişkin çözüm önerilerini nicel ve nitel verilerle destekleyerek uzman olan ve olmayan kişilerle paylaşır.

P.O. 15 : Alanı ile ilgili yabancı kaynakları takip edebilecek düzeyde yabancı dil bilgisine sahiptir.

P.O. 16 : Bilgi ve iletişim teknolojilerini fen bilimleri öğretiminde etkin bir şekilde kullanır.

P.O. 17 : Fen, Teknoloji, Mühendislik, Matematik ve Eğitim disiplinlerinde; edindiği bilgi ve becerileri eleştirel biçimde değerlendirerek, bunları problemlerin çözümünde kullanır.

P.O. 18 : Çevre koruma ve iş güvenliği konularında yeterli bilince sahiptir.

P.O. 19 : Güvenli okul ortamının oluşturulması ve sürdürülebilmesi amacıyla kişisel ve kurumsal etkileşim kurar.

P.O. 20 : Kalite yönetimi ve süreçlerine uygun davranır ve katılır.

P.O. 21 : Farklı kültürlere ve sosyal yaşama uyum sağlar.

P.O. 22 : Dış görünüm, tutum, tavır ve davranışları ile topluma örnek olur.

P.O. 23 : Sanatsal ve kültürel etkinliklere etkin olarak katılır.

P.O. 24 : Toplumun ve dünyanın gündemindeki olaylara/gelişmelere duyarlıdır ve bu gelişmeleri izler.

P.O. 25 : Toplumsal sorumluluk bilinciyle yaşadığı sosyal çevre için mesleki proje ve etkinlikler planlar ve uygular

L.O. 1 : Isı ve sıceklık ile ilgili temel kavramları günlük hayatla ilişkilendirebilir.

L.O. 2 : Dalgaların farklı ortamlardaki hareketlerini analiz edebilir

L.O. 3 : Klasik fizik ile modern fizik arasındaki benzerlik ve farklılıkları açıklayabilir.

L.O. 4 : Atom ve atom modellerini açıklayabilir

L.O. 5 : Fotoelektrik ve Compton Olaylarını kapsayan problemleri çözebilir.

L.O. 6 : Termodinamiğin yasalarını kullanarak termodinamik uygulamaları sorgulayabilir.

L.O. 7 : Geometrik optiğin temel kavram ve prensiplerini bilir.

L.O. 8 : Günlük yaşamda ve modern teknolojilerde (GPS sistemleri, parçacık hızlandırıcılar vb.) özel göreliliğin rolünü değerlendirebilir.