Identification	**Subject (code, title, credits)**	ETR250, Materials of electrical and electronic equipment, 6 ECTS
	Department	Physics and Electronics
	Program (undergraduate, graduate)	Undergraduate
	Term	Spring 2026
	Instructor	PhD, Ahmad Asimov
	E-mail:	fizikasimov@gmail.com
	Phone:	255 (Daxili)
	Classroom/hours	302N Monday/Wednesday
	Office hours	Tuesday: 15:00-16:00/ Thursday: 15:00-16:00
Prerequisites		
Language	English	
Compulsory	Compulsory	
Required textbooks and course materials	1. Principles of Electronic Materials and Devices. Kasap, S.O. McGraw-Hill 2012 2. Advanced Electrical and Electronics Materials: Processes and Applications. K. M. Gupta & Nishu Gupta — 2015 3. Principles of Electronic Materials and Devices. Safa O. Kasap — 4th Edition (2017 / 2018) 4. Electronic, Magnetic, and Optical Materials. Pradeep Fulay & Jung-Kun Lee — 2016 (2nd Edition) 5. Handbook of Electronic Devices and Materials. Edited by Various Authors (Springer Handbook) 2020 / 2021 (approximate modern edition year) 6. Materials for Electrical Engineering. J.C. Andreas & A. P. Malvino — 2018 7. Fundamentals of Materials Science for Technologists. Leslie V. Interrante & Charles J. Hudak Jr. 2019 (latest edition) 8. Materials Science and Engineering: An Introduction. William D. Callister & David G. Rethwisch — 10th Edition (2018) (Foundation for understanding material properties)	
Course description	This course introduces undergraduate students to the basic concepts of materials science and solid-state physics. The course covers the structure of materials at the atomic and crystal levels, including crystal lattices, bonding types, and common defects in solids. Students will learn how the internal structure of materials affects their physical properties. The electronic structure of solids is presented in a simplified manner, focusing on the differences between conductors, semiconductors, and insulators. The course also explores the thermal, electrical, dielectric, and magnetic properties of materials, providing fundamental understanding of how materials respond to heat, electric fields, and magnetic fields.	
Course objectives	The course aims to: 1. Explain classification, properties and characteristics of electrical and electronic engineering materials. 2. Analyze and predict future directions in the use of electronic materials and design of electronic devices. 3. Illustrate solving simple problems based on dielectric, magnetic and conducting materials. 4. Impart knowledge of Nanotechnology to electrical engineering.	

	5. Understand and explain the fundamental principles underlying the operation of various electronic devices 6. Introduce the processing methods for materials used in the semiconductor industry.		
Learning outcomes	On successful completion of this course students will be able to: 1. Describe the characteristics of conducting and semiconducting materials 2. Apply knowledge of nanotechnology to electrical engineering 3. Classify and describe different insulators and explain the behaviors of dielectrics in static and alternating fields 4. Solve simple problems based on dielectric, magnetic and conducting materials 5. Classify and describe Solar energy materials and superconducting materials 6. Discuss classification, properties and characteristics of different electrical engineering materials		
Teaching methods	**Case analysis**		x
	Group discussion		x
	Lecture		x
	Simulation		x
Evaluation Criteria	**Methods**	**Date/deadlines**	**Percentage (%)**
	Midterm Exam		**30**
	Attendance	At the end of the semester	**5**
	Quizzes	4 quizzes during the semester	**20**
	Activity	During the semester	**5**
	Final Exam		**40**
	Total		**100**

Class Policy	▪ **Preparation for class** The structure of this course makes your individual study and preparation outside the class extremely important. The lecture material will focus on the major points introduced in the text. Reading the assigned chapters and having some familiarity with them before class will greatly assist your understanding of the lecture. Afterthe lecture, you should study your notes and work on relevant problems and cases from the end of the chapter and sample exam questions. ▪ **Withdrawal (pass/fail)** This course strictly follows the grading policy of the School of Science and Engineering. Thus, a student is expected to achieve a mark of at least60% to pass. In case of failure, he/she will be required to repeat the course the following term or year. ▪ **Cheating/plagiarism** Cheating or other plagiarism during the Quizzes, Midterm, and Final Examinations will lead to paper cancellation. In this case, the student will automatically get zero (0) without consideration. ▪ **Professional behavior guidelines** The students shall behave in a way to create a favorable academic and professional environment during class hours. Unauthorized discussions and unethical behavior are strictly prohibited. ▪ **Quizzes** There will be 4 quizzes in the semester. The quizzes will be announced in the classroom two weeks before. Quiz is from homework problems. The homework problems will be selected from questions and problems in the end of each chapter. The number of homework problems will be announced after finishing each chapter. ▪ **Attendance** Attendance refers to the student's presence in classroom. Students should attend all classes. Failure to do so will result in the deduction of points from the 'attendance' component of their final grade. Ten percent (5%) of the total grade will depend upon attendance in class. ▪ **Activity** Students who will be active during discussion of past lessons will be awarded with one activity mark.

Tentative Schedule

Week	Date/Day (tentative)	Topics	Textbook
1	17.02.26 21.02. 26	Classes of Engineering Materials: Metals & alloys, organic polymers and composite material. Classification of solids from electrical Engineering point of view.	Chapter 1 [1]
2	24.03. 26 28.03. 26	Conducting material – properties of conductors, characteristics of good conductor material, commonly used conducting materials, Thermal conductivity of matter, super conductivity.	Chapter 2 [1]

3	03.03. 26 07.03. 26	Dielectric Materials and Insulators: Dielectric strength, factors affecting dielectric strength, dielectric loss, dissipation factor, factors affecting dielectric loss.	Chapter 3 [1]
4	10.03. 26 14.03. 26	Application of dielectric, different types of capacitors and materials used for them. Insulating materials, their properties – thermal, chemical, mechanical & electrical.	Chapter 4 [1]
5	17.03. 26 21.03. 26	Classification of magnetic materials: Dia-magnetism, Para magnetism, Ferro-magnetism, Anti – ferromagnetism,	Chapter 5 [1]
6	24.03. 26	Ferrimagnetism, Magnetic resonance, ferromagnetic materials, soft and hard magnetic materials, ferrites. Fiber optic materials	Chapter 6 [1]
7	28.03. 26 04.04. 26	Semiconductors Materials: Basic Concept- types characteristics-applications: type of semi conductors, working and applications of semiconductors, Temperature sensitive elements.	Chapter 7 [1]
8		Midterm	
9	07.04. 26 11.04. 26	Solar Energy Materials: Photo thermal conversion. Solar selective coatings for enhanced solar thermal energy collection –Photovoltaic conversion – Solar cells -Silicon, Cadmium sulphide and Gallium arsenic – Organic solar cells.	Chapter 8 [1]
10	14.04. 26 18.04. 26	Special purpose materials: Nickel iron alloys, high frequency materials, permanent magnet materials.	Chapter 9 [1]
11	21.04. 26 25.04. 26	Materials for solar cells, fuel cells and battery. Materials for coatings for enhanced solar thermal energy collection and solar selective coatings	Chapter 10 [1]
12	28.04. 26 02.05. 26	Nanomaterials In Modern Technology: Introduction and properties, synthesis of nanomaterials, Carbon Nano Tubes,	Chapter 11 [1]
13	05.05. 26 16.05. 26	Characterization techniques of nanomaterials- SEM, TEM, EDAX, FMR, XRD. Applications of nanomaterials	Chapter 12 [1]
14	19.05. 26 23.05. 26	Modern Techniques for materials studies: Optical microscopy – Electron microscopy – Photo electron spectroscopy	Chapter 13 [1]
15	26.05. 26 30.05. 26	Introduction to Biomaterials and Nanomaterials	Chapter 14 [1]
		Final Exam