

University of Raparin

College of Science

Department of Physics



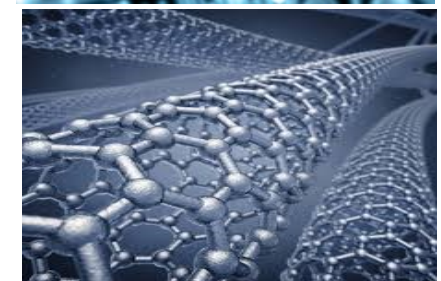
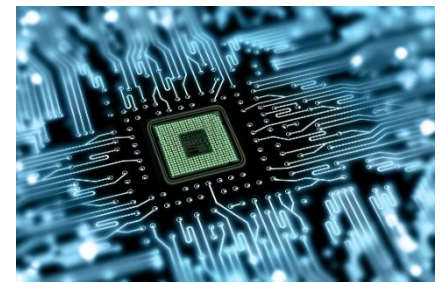
Course Book

Material Science



B.Sc. Degree in Physics
Academic Year 2010-2021

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Course Objective

- ✓ To explain relevant concepts.
- ✓ To develop skills in formulating and solving problems.
- ✓ An introductory of fundamentals of optics and some of the important applications.

Forms of Teaching (online)

Different forms of teaching will be used to reach the objectives of the course:

1- Power point presentations for the titles, definition of terms, classification of materials and any other illustrations. Furthermore, we will try to use attractive animations in order to make a better imagination.

3- Given outline examples for more understanding and connecting with issues.

4- Given homework after each lecture and quizzing them to provide further challenge.

3- Furthermore students will be asked to prepare research papers on selective topics.

4- You will be informed for getting examinations or short quizzes.

5- We give some take-home (Homework) as an activity that should be submitted before the deadline.

6- Every student must have his own/ her own university e-mail. We will use "Google Classroom" during our study, and student's activities should be submitted from their proper account.

Grading

Students are required to do more than two tests or exams, for both practical and theoretical:

	Daily activities	First monthly exam	Daily activities	second monthly exam	Final exam	Total
Theoretical	5	20	5	20	50	100

Reference Books

Required books are:

- ✓ Callister, W. D. (2013). Materials science and engineering an introduction. John Wiley. 9th Edition

And any other books of physics published in 21st century. The core materials of the course consisting the book, articles papers and internet.

Course Materials

PHYSICS (Theoretical) /syllabus

1. Introduction

- Classification of Materials

2. Atomic Structure and Interatomic Bonding

- Atomic Structure
- Atomic Bonding in Solids

3. Atomic Structure Atomic Bonding in Solids

- Crystal Structure
- Crystallographic Points, Directions, and Planes
- Crystalline and Noncrystalline Materials

4. Imperfections in Solids

- Point Defects
- Miscellaneous Imperfections
- Microscopic Examination

5. Diffusion

- Diffusion Mechanisms
- Fick's Laws

6. Mechanical Properties of Metals

- Elastic Deformation
- Plastic Deformation
- Property Variability and Design/Safety Factors

7. Dislocations and Strengthening Mechanisms

- Dislocations and Plastic Deformation
- Mechanisms of Strengthening in Metals
- Recovery, Recrystallization, and Grain Growth

8. Failure

- Fracture

- Fatigue
 - Creep
- 9. Phase Diagrams**
- Definitions and Basic Concepts
 - Binary Phase Diagrams
 - The Iron–Carbon System
- 10. Phase Transformations: Development of Microstructure and Alteration of Mechanical Properties**
- Phase Transformations
 - Microstructural and Property Changes in Iron–Carbon Alloys
- 11. Applications and Processing of Metal Alloys**
- Types of Metal Alloys
 - Fabrication of Metals
 - Thermal Processing of Metals
- 12. Structures and Properties of Ceramics**
- Ceramic Structures
 - Mechanical Properties
- 13. Applications and Processing of Ceramics**
- Types and Applications of Ceramics
 - Fabrication and Processing of Ceramics
- 14. Polymer Structures**
- Characterizations of Polymers
 - Copolymers
- 15. Characteristics, Applications, and Processing of Polymers**
- Mechanical Behavior of Polymers
 - Mechanisms of Deformation and For Strengthening of Polymers
 - Crystallization, Melting, and Glass- Transition Phenomena in Polymers
 - Polymer Types
 - Polymer Synthesis and Processing
- 16. Composites**
- Particle-Reinforced Composites
 - Fiber-Reinforced Composites
 - Structural Composites
 - Corrosion and Degradation of Materials
 - Corrosion of Metals
 - Corrosion of Ceramic Materials
 - Degradation of Polymers
- 17. Electrical Properties**
- Electrical Conduction
 - Semiconductivity
 - Electrical Conduction in Ionic Ceramics and In Polymers

- Dielectric Behavior
- Other Electrical Characteristics of Materials

18. Thermal Properties

- Heat Capacity
- Thermal Expansion
- Thermal Conductivity
- Thermal Stresses

19. Magnetic Properties

- Basic concepts
- Types of materials
- Characterizations

20. Optical Properties

- Basic Concepts
- Optical Properties of Metals
- Optical Properties of Nonmetals
- Applications of Optical Phenomena

21. Economic, Environmental, and Societal Issues in Materials Science and Engineering

- Economic Considerations
- Environmental and Societal Considerations

This syllabus may be subject to changes, i.e., we may take shorter time, if any changes happened you will be notified well in advance.