Bangladesh University of Engineering and Technology
Department of Physics

Course Teacher: Dr. Mehnaz Sharmin

Course Outline

Program:	**Water Resource Engineering (WRE)**
Course Title:	Structure of Matter, Electricity and Magnetism and Modern Physics
Course Code:	PHY-153
Semester:	January 2022
Level:	1st year 2nd semester
Credit Hour:	3.0
Name & Designation of the Teacher:	Dr. Mehnaz Sharmin Associate Professor Department of Physics
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Rationale: This course in physics is developed on elementary level, which includes Special Theory of Relativity, Quantum Theory of Radiation and basic nuclear physics. The course may provide quantitative and analytic skills needed for analyzing data and solving problems, moreover it is highly relevant to engineering.
Structure of Matter is fundamental part of Solid State Physics which basically deals with the different classes of solids and their structure. Solid is one of the three stable states of matter which can only have definite structure. Solid is very essential in everyday life since it is useful in almost all scientific, industrial and household purposes. Structure of a solid affects almost all the physical properties of the solid. So, it is essential acquire a good knowledge about structure and properties of solids to clarify the understanding of their fields of applications. This course is expected to be helpful in providing quantitative and analytic skills for dealing with the structure of solid and solving relevant problems of engineering.

Pre-requisite (if any)**:** None

Course Synopsis: Crystalline and non-crystalline solids, Single crystal and polycrystal solids, Unit cell, Crystal systems, Co-ordinations number, Crystal planes and directions, NaCl and CsCl structure, Packing factor, Miller indices, Relation between interplanar spacing and Miller indices, Bragg's Law, Methods of determination of interplanar spacing from diffraction patterns; Defects in solids: Point defects, Line defects; Bonds in solids, Interatomic distances, Calculation of cohesive and bonding energy; Introduction to band theory: Distinction between metal, Semiconductor and insulator

Course Objectives:

The learning objectives of this course are to-

1. Learn about different types of solid and their structures.
2. Develop the theoretical knowledge for analyzing crystal structure.

3. Understand crystal directions and structural parameters.
4. Acquire knowledge about the laws of structural analysis.
5. Enrich the acquaintance of experiments used for crystallographic measurements.
6. Comprehend types of bonding in solids and their inherent characteristics.
7. Clarify the fundamental concept of band theory of solid.
8. Be acquainted with different types of defects in crystalline solids and their importance.

Tentative Lecture Plan

Lectures	Topics
1-3	Crystalline and non-crystalline solids, Single crystal and polycrystalline solids, Unit cell, Crystal systems, Co-ordinations number, Density and Packing factor.
4-6	Crystal planes and directions, Miller indices, Relation between interplanar spacing and Miller indices, Crystal structure: NaCl, CsCl, etc.
7-8	Bragg's Law, Methods of determination of interplanar spacing from diffraction patterns.
9-10	Bonds in solids, Interatomic distances, Calculation of cohesive and bonding energy.
11-12	Introduction to band theory: Distinction between metal, semiconductor and insulator.
13-14	Defects in solids: Point defects, Line defects, Plane defects, Volume defects.

Learning Resources

1. Solid State Physics – M. A. Wahab (2nd Ed.)
2. Introduction to Solid State Physics – Charles Kittel (5th Ed.)
3. Concepts of Modern Physics- Arthur Beiser
4. Physics for Engineers (Part-2)- Dr. Gias Uddin Ahmad
5. Lecture notes will be uploaded in the MS class team.

Program Outcomes (POs)

After finishing this course, a student will be capable to -

- Classify solids in terms of their structure.
- Describe and drawing different types of crystal structure.
- Analyze crystal directions.
- Identify different types of structure from the information gained from crystallographic measurements.
- Calculate various crystallographic parameters.
- Compute cohesive energies of a solid.
- Distinguish various types of solid in the light of Band theory.
- Elucidate different kinds of defects in solids and their importance.

Teaching Methods:

1. Lecture
2. Discussion
3. Question & Answer
4. Demonstration
5. Problem Solving

Assessment Policies:

Attendance: Class attendance is very important since by missing a class you may miss a class test that may be equivalent to a failed class test and it carries 10% weight of your grade, cannot be recovered unless the absence is appropriately justified and excused.

Class Test/Quizzes: There will be a total of four class tests in this course. Three teachers will be teaching this course and each teacher will be taking at least one class tests. Lowest score of the (four) CT will be dropped. If you miss any class test, it will count at the lowest score, and will be dropped. **So, no make-up for any class test.** You can expect one/two class test from Modern Physics.

Conduct: Please turn off your cell phones before entering class, and please don't have any sidebar conversations during class. There will be ample opportunity for you to talk during class at certain times. However, it is imperative that the class is quiet at all other times so that your fellow students are not distracted. I encourage you to raise your hand and ask relevant questions in class.

Collaboration Policy: Collaboration during exams is strictly prohibited. Exams will be of the usual closed-book, closed-notes type. On the other hand, in order to learn the materials, collaboration and group discussions outside of classroom are highly encouraged.

Calculators and Laptops: A non-graphic, non-programmable calculator Calculators may be used for exams. While in the class any calculators can be used. You may take notes on a laptop. However, you may not use your laptop for Facebook, web surfing, or other activities not directly related to class.

You will not be allowed to use your cellphone as a calculator in the test.

Grading System:

The total performance of a student in a given course is based on a scheme of continuous assessment. For theory courses this continuous assessment is made through a set of quizzes/in class evaluation, class participation, homework assignments, and a term final examination. Thirty per cent of marks of a theoretical course shall be allotted for continuous assessment i.e., quizzes and homework assignments, in class evaluation and class participation. The remainder of marks will be allotted to Term Final examination of 3-hour duration, which will be conducted centrally by the university. There will be internal and external examiners for each course in the term final examination. The distribution of marks for a given theoretical course will be as follows:

Items	Marks (%)
Class Attendance	10 %
Quizzes	20 %
Term final examination: Internal (Section A) External (Section B)	 35 % 35 %
Total	100 %

All students are expected to attend classes regularly. The university believes that attendance is necessary for effective learning. The first responsibility of a student is to attend classes regularly, and one is required to attend at least 60% of all classes held in every course. Basis for awarding marks for class participation and attendance will be as follows:

Attendance	Marks
90% and above	10
85% to less than 90%	9
80% to less than 85%	8
75% to less than 80%	7
70% to less than 75%	6
65% to less than 70%	5
60% to less than 65%	4
Less than 60%	0

Letter grades and corresponding grade points will be awarded in accordance with the provisions shown below:

Numerical Grade	Letter Grade	Grade Point
80% or above	A+ (A plus)	4.00
75% to less than 80%	A (A regular)	3.75
70% to less than 75%	A- (A minus)	3.50
65% to less than 70%	B+ (B plus)	3.25
60% to less than 65%	B (B regular)	3.00
55% or less than 60%	B- (B minus)	2.75
50% to less than 55%	C+ (C plus)	2.50
45% to less than 50%	C (C regular)	2.25
40% to less than 45%	D (D regular)	2.00
Less than 40%	F	0.00