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| AIUB-Logo | **AMERICAN INTERNATIONAL UNIVERSITY-BANGLADESH (AIUB)**  Faculty of Science & Technology  Department of Physics  Undergraduate Program |

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| **COURSE PLAN Fall 2021-2022 SEMESTER** |

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| **I**. Course Minor and Title  **PHY-1203: Physics 2**  **II**. Credit  **3 credit hours (3 hours of theory per week)**  **III**. Nature  **Minor Course for CS and EEE**  **IV**. Prerequisite  **PHY-1102: Physics 1** |  | **V. Mission: AMERICAN INTERNATIONAL UNIVERSITY-BANGLADESH (AIUB) is committed to provide quality and excellent computer-based academic programs responsive to the emerging challenges of the time. It is dedicated to nurture and produce competent world class professional imbued with strong sense of ethical values ready to face the competitive world of arts, business, science, social science and technology.**  **VI. Vision: AMERICAN INTERNATIONAL UNIVERSITY-BANGLADESH (AIUB) envisions promoting professionals and excellent leadership catering to the technological progress and development needs of the country.** |

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| **VII - Course Description:** |

Physics 1203 (Heat and Thermodynamic &Oscillations, Waves and Optics) also known as Physics 2, covers: (1) classical description of gases involving thermodynamic processes. Systematic microscopic picture is presented and thermodynamic laws are thoroughly discussed culminating in functional description of heat engines and its application, (2) in the second part, starting with SHM of a particle, the ideas of continuous mechanical waves and their superposition effects are presented, (3) in the third part, the ideas of continuous mechanical waves are extended to include discussion of light waves and its properties as demonstrated by interference and diffraction phenomena.

Physics 2 course is designed as follows:

* **Temperature, heat and the first law of thermodynamics:** Temperature (temperature, the zeroth law of thermodynamics), Absorption of heat (temperature and heat), The absorption of heat by solids and liquids (heat capacity, specific heat, molar specific heat, heat of transformation), The first law of thermodynamics (a closer look at heat and work, the first law of thermodynamics), Some special cases of the first law of thermodynamics (adiabatic processes, constant-volume processes, cyclical processes, free expansions)
* **The kinetic theory of gases:** Ideal gases (ideal gases, work done by an ideal gas at constant temperature, work done at constant volume and at constant pressure), Pressure, Temperature, and RMS speed, Translational kinetic energy, The molar specific heats of an ideal gas (internal energy, molar specific heat at constant volume, molar specific heat at constant pressure), The adiabatic expansion of an ideal gas
* **Entropy and the second law of thermodynamics****:** Entropy (irreversible processes and entropy, change in entropy, the second law of thermodynamics), Entropy in the real world: Engines (a Carnot engine, efficiency of a Carnot engine), Refrigerators and real engines (entropy in the real world: refrigerators, the efficiencies of real engines)
* **Oscillations:** Simple harmonic motion (simple harmonic motion, the velocity of SHM, the acceleration of SHM, the force law for simple harmonic motion), Energy in simple harmonic motion, Circular motion (simple harmonic motion and uniform circular motion), Damped simple harmonic motion
* **Traveling and standing waves:** Transverse waves (types of waves, transverse and longitudinal waves, wavelength and frequency, amplitude and phase, wavelength and angular wave number, period, angular frequency and frequency, phase constant, the speed of a traveling wave, Wave speed on a stretched string (derivation from Newton’s second law), Energy and power of a wave traveling along a string (kinetic energy, elastic potential energy, energy transport, the rate of energy transmission), Interference of waves (the principle of superposition for waves, interference of waves), Standing waves and resonance (standing waves, reflections at a boundary, standing waves and resonance)
* **Interference and Diffraction:** Light as a wave, Diffraction, Young’s interference experiment (diffraction, Young’s interference experiment, locating the fringes), Interference and double-slit intensity (coherence, Intensity in double-slit interference), Interference from thin films (interference from thin films, reflection phase shifts, equations for thin-film interference, film thickness much less than λ), Single-slit diffraction

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| **VIII – Course Outcomes (CO) Matrix:** |

By completing this course, students should be able to understand the basic concepts, analyze and apply those to solve both analytical and numerical problems related to practical situations.

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|  |  | Level of Domain | | | | PO Assessed |
| C | P | A | S |
| CO1 | Define temperature and heat, and describe thermal processes introducing concept of 1st law of thermodynamics. | 1 |  |  |  | 1 |
| CO2 | Microscopic theory of ideal gas is discussed with the derivation of relations between specific heats. | 4 |  |  |  | 2 |
| CO3 | 2nd law of thermodynamics is discussed, and concept of entropy presented. And in conjunction with CO1 and CO2, the working principle of heat engines is discussed and applied to the derivation of efficiency. | 3& 4 |  |  | CT | 2 |
| CO4 | Ideas of Simple Harmonic Motion (SHM) are discussed and applied to calculation of total energy of an oscillator. | 3 |  |  |  | 1 |
| CO5 | Phenomenon of mechanical wave motion is discussed, including traveling and stationary waves using the superposition principle. Above concept is applied to the formation of resonance phenomena on a stretched string. | 3 &  4 |  |  | CT | 2 |
| CO6 | Ideas of mechanical waves are extended to include light waves as these undergo interference and diffraction phenomena. | 1&3 |  |  | CT | 1 |
| *C: Cognitive; P: Psychomotor; A: Affective; S: Soft-skills (CT: Critical Thinking, TS: Teamwork)* | | | | | | | |

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| **IX – Topics to be Covered\*:** |

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| **Time Frame** | **CO** | **Topics** | **Teaching Activities** | **Assessment** | **Evidence** |
| **WEEK 1** | CO1 | Mission & Vision of AIUB, Dept. of Physics; Objective of Physics 2 course.  Temperature, the zeroth law of thermodynamics, Absorption of heat (temperature and heat), The absorption of heat by solids and liquids (heat capacity, specific heat, molar specific heat, heat of transformation) | Lecture  Tutorial | Theoretical/ Calculation based test | Class performance |
| **WEEK 2** | CO1 | A closer look at heat and work, the first law of thermodynamics, Some special cases of the first law of thermodynamics (adiabatic processes, constant-volume processes, cyclical processes, free expansions) | Lecture  Tutorial | Quiz |
| **WEEK 3** | CO1 | Ideal gases, work done by an ideal gas at constant temperature, work done at constant volume and at constant pressure, Pressure, Temperature, and RMS speed, Translational kinetic energy, | Lecture  Tutorial |  |
| **WEEK 4** | CO2 | The molar specific heats of an ideal gas (internal energy, molar specific heat at constant volume, molar specific heat at constant pressure), The adiabatic expansion of an ideal gas | Lecture  Tutorial | Quiz |
| **WEEK 5** | CO2 | Entropy (irreversible processes and entropy, change in entropy, the second law of thermodynamics) | Lecture  Tutorial |  |
| **WEEK 6** | CO2 | Entropy in the real world: Engines (a Carnot engine, efficiency of a Carnot engine), Refrigerators and real engines (entropy in the real world: refrigerators, the efficiencies of real engines) | Lecture  Tutorial | Quiz |
| **WEEK 7** |  | **MID-TERM WEEK** | | | |
| **WEEK 8** | CO3 | Simple harmonic motion, the velocity of SHM, the acceleration of SHM, the force law for simple harmonic motion, Energy in simple harmonic motion, | Lecture  Tutorial | Theoretical/ Calculation based test | Quiz |
| **WEEK 9** | CO3 | Simple harmonic motion and uniform circular motion, Damped simple harmonic motion | Lecture  Tutorial |
| **WEEK 10** | CO4 | Types of waves, transverse and longitudinal waves, wavelength and frequency, amplitude and phase, wavelength and angular wave number, period, angular frequency and frequency, phase constant, the speed of a traveling wave, Wave speed on a stretched string | Lecture  Tutorial |  |
| **WEEK 11** | CO5 | Energy and power of a wave traveling along a string (kinetic energy, elastic potential energy, energy transport, the rate of energy transmission), Interference of waves (the principle of superposition for waves, interference of waves), Standing waves and resonance (standing waves, reflections at a boundary, standing waves and resonance) | Lecture  Tutorial | Quiz |
| **WEEK 12** | CO5 | Light as a wave, Diffraction, Young’s interference experiment (diffraction, Young’s interference experiment, locating the fringes), Interference and double-slit intensity (coherence, Intensity in double-slit interference), | Lecture  Tutorial |  |
| **WEEK 13** | CO6 | Interference from thin films (interference from thin films, reflection phase shifts, equations for thin-film interference, film thickness much less than λ), Single-slit diffraction | Lecture  Tutorial | Quiz |
| **WEEK 14** |  | **FINAL-TERM WEEK** | | | |

\* The faculty reserves the right to change, amend, add or delete any of the contents.

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| **XI – Course Requirement:** |

At least **80% class attendance** is necessary to sit for the examination. If there is any assignment given to the students, they have to submit it before the deadline decided by the course teacher.

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| **XII – Evaluation Grading System:** |

The evaluation system will be strictly followed as par the AIUB grading policy. The following grading system will be strictly followed in this class.

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| **Marking system For Theory Classes (Midterm and Final term)** | |  |
| Attendance and Performance | 10% |  |
| Quiz | 40% |  |
| Viva | 25% |  |
| Midterm/Final term exam | 25% |  |
| **Total** | 100% |  |
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| **Final Grade/ Grand Total** |  |  |
| Midterm: | 40% |  |
| Final Term: | 60% |  |

**Grand Total : 40% of Midterm + 60% of Final Term**

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| **Letter** | **Grade Point** | **Numerical %** |
| A+ | 4.00 | 90-100 |
| A | 3.75 | 85-<90 |
| B+ | 3.50 | 80-<85 |
| B | 3.25 | 75-<80 |
| C+ | 3.00 | 70-<75 |
| C | 2.75 | 65-<70 |
| D+ | 2.50 | 60-<65 |
| D | 2.25 | 50-<60 |
| F | 0.00 | <50(Failed) |

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| **XIII – COs and POs Assessment** |

Not count for Assessment

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| **XIV – Teaching Method** |

Text book will be used as followed. Syllabi and problem sheets are uploaded. White board will be used for most of the time. For some cases, multimedia projector will sometimes be used for the convenience of the students. Students must study up to the last lecture before coming to the class and it is suggested that they should go through the relevant chapter before coming to the class. Just being present in the class is not enough- students must participate in classroom discussions. Students will be encouraged to study current in their studies and come to class regularly.

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| **XV – Textbook** |

Textbook:

Fundamentals of Physics (10th edition, Extended): David Halliday, Robert Resnick and Jearl Walker

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| **XVI - List of Faculty Teaching the Course** |

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| Theory Faculty Members are as follows: | |
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| **XVII – Verification** | | | |

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| Prepared by:  Dr. Md. Nurul Kabir Bhuiyan  Senior Assistant Professor  Physics 2 Course Convenor  Physics Department  Faculty of Science and Technology | Checked and certified by:  Dr. Humayra Ferdous  Head of Department (In-charge)  Associate Professor  Physics Department  Faculty of Science and Technology | Approved by:  Dr. Mashiour Rahman  Associate Professor and  Associate Dean  Faculty of Science and Technology  Professor Dr. T. Hossain  Dean  Faculty of Science and Technology |
| Date: | Moderated by:  Date: | Moderated by:  Date: |