Military Institute of Science and Technology (MIST)

Department of ENVIRONMENTAL, WATER RESOURCES AND COASTAL ENGINEERING (EWCE)

Course Code & Title: **PHY 101: Waves and Oscillations,** Optics and Modern Physics.

Credit Hours: 3.0, Contact Hours: 3.0, Total Number of Classes: $14 \times 3 = 42$

System: OBE, Semester: Fall 2023

Waves and Oscillations (1 Credit)

Location: Tower No _____, Room No _____.

Class Time: TUESDAY 1245-1340.

Course Instructor: Rafid Buksh.

(M.Sc. & B.Sc. from Department of Physics, Dhaka University)

Contact: _____

Assessment System: Total Marks: 300	
Class Test: 20 x 2 = 40 (60) (Best 2 out of 3)	Attendance: 15 Individual Assessment: 15
Mid Term Test: 30	Final Exam: 90 x 2 = 180

Reference Books

1. **Physics for Engineers, Part-1: Dr. Gias Uddin Ahmad.**

2. Fundamentals of Physics: Halliday, Resnick, and Walker.

3. University Physics with Modern Physics: Hugh D. Young and Roger A. Freedman.

4. Waves and Oscillations: BrijLal and Subramannyam.

Course Content of W&O (01 Credit)

1. Introduction
a. Linear and Rotational Motion
b. Degrees of Freedom and Coordinate System
c. Periodic and Oscillatory Motion
d. Definition: Simple Harmonic Motion

2. Undamped SHM
a. Constraints of SHM
b. Equation of SHM in Equilibrium
c. Differential Equation of Undamped SHM
d. Solving Undamped SHM
e. Velocity and Acceleration
f. Kinetic, Potential and Average energy
g. Total Energy and Conservation Principle

3. Superposition Principle
a. Superposition Principle of Linear System
b. Superposition of SHMs along a straight line and at right angle
c. Lissajous Figure

4. SHM with gravity: Pendulum
a. Influence of Gravity in Mass-Spring System
b. Gravity instead of Spring
c. Simple, Compound, and Torsional Pendulum

5. Damped Harmonic Motion
a. Differential Equation of damped SHM
b. Solving Damped DE for a General Solution, Three Cases
c. Under Damped, Critically Damped, Over Damped System

6. Forced SHM
a. Forced Systems and Examples
b. Differential Equation and General Solution
c. Resonance and Driving Frequency

7. Coupled Oscillator
a. Coupled Oscillator: Two body, DE, Solution, Modes
b. Generalized to n Coupled Oscillator, DE, Solution, Modes
c. Infinite Coupled Oscillator, DE, Waves.

8. Wave
a. Intro to wave, Mechanical wave, EM waves.
b. Transverse and Longitudinal waves.
c. Progressive Wave- phase & group velocity, Energy Density
d. Differential Equation of a progressive wave & General Solution
e. Propagation vector, frequency, Time period and Velocity
f. Standing wave- fixed end harmonics, determination of Velocity

"If you want to find the secrets of the universe, think in terms of energy, frequency and vibration. "– Nikola Tesla.