**Physics 1 [Mid Term Lesson Plan]**

**MARKS DISTRIBUTION**

**ATTENDANCE AND PERFORMANCS: 10 (10%)**

**QUIZZES: BEST TWO OUT OF THREE QUIZZES: 40 (40 %)**

**TERM EXAM: 50 [WRITTEN (25 POINTS) AND ORAL (25 POINTS] (50%)**

**TERM EXAM QUESTION TYPE**

**QUALITATIVE MCQ: 8×1 = 8 POINTS**

**QUANTITATIVE/NUMERICAL/ANALYTICAL MCQ: 8×1 = 8 POINTS**

**CREATIVE/DESCRIPTIVE/ANALYTICAL QUESTIONS/PROBLEMS: 3 × (2×4) = 24 POINTS**

**TOTAL = 100 POINTS/MARKS**

**Reference Books:** *Fundamentals of Physics (Edition: 10th) Written by Halliday, Resnick and Walker and University Physics (13/14th Edition) written by* *Hugh D. Young and Roger A. Freedman*

**Lesson 1**

* **Introduction about the course** [20 min] [Attendance/performance/Quizzes/Term exams]

Reference Book: Fundamentals of Physics (10th Edition)

Written by Halliday, Resnick and Walker

**Book Chapter 4**

**[Motion in Two and Three Dimensions]**

* **Position and Displacement :** [20 min]

(i) **Create** two-dimensional and three-dimensional position vectors for a particle,

indicating the components along the axes of a coordinate system.

(ii) Apply the relationship between a particle’s displacement vector and its initial and

final position vectors.

* **Average Velocity and Instantaneous Velocity:** [20 min]

(i) Define average velocity and instantaneous velocity.

(ii) Create a particle’s position vector as a function of time and evaluate its (instantaneous)

velocity vector.

* **Average Acceleration and Instantaneous Acceleration:** [15 min]

(i)Define average acceleration and instantaneous acceleration.

(ii)Create a particle’s velocity vector as a function of time and evaluate its

(Instantaneous) acceleration vector.

* Problems: 3 and 13 to be solved (book chapter 4) [15 min]

**Lesson 2**

* Attendance [10 min]

(Continuation of book chapter 4)

* **Projectile Motion:**

(i) Define projectile motion. [10 min]

(ii)On a sketch of the path taken in projectile motion, analyze the magnitudes [20 min]

and directions of the velocity and acceleration components during the flight.

(iii) Create equations for horizontal and vertical motions of a projectile. [15 min]

(iv) Show that the path of a projectile is a parabola. [10 min]

(v) Find the equations for the horizontal range and the maximum horizontal [15 min]

range of a projectile.

* Problem: 22 (book chapter 4) [to be solved in the class time] [10 min]

**Lesson 3**

* Attendance [10 min]

(Continuation of book chapter 4)

* Problems: 23, 25, 30 and 32 (book chapter 4) [to be solved in the class time] [40 min]

**Book Chapter 5**

**[Force and Motion-1]**

* Analyze Newton’s First, Second and Third laws. [30 min]

* Create and analyze a free-body diagram for an object, showing the object as a particle

and drawing the forces acting on it as vectors. [10 min]

**Lesson 4**

* Attendance [10 min]

(Continuation of book chapter 5)

* **QUIZ 1** [20 min]
* Arrangement time for Quiz 1 [10 min]
* **Define the following terms:**  [40 min]

(i) The gravitational force

(ii) Weight

(iii) The normal force

(iv) Friction

* Problem: 3 (book chapter 5) [to be solved in the class time] [10 min]

**Lesson 5**

* Attendance [10 min]

(Continuation of book chapter 5)

* Problems: 33 and 37 (book chapter 5) to be solved in the class time [30 min]

**Book Chapter 6**

**[Force and Motion-II]**

* Analyze the properties of friction (with free body diagram and graph). [40 min]
* Distinguish between friction in a static situation and a kinetic situation. [10 min]

**Lesson 6**

* Attendance [10 min]

(Continuation of book chapter 5)

* Problems: 1, 7 and 11 (book chapter 6) [to be solved in the class time] [30 min]

**Book Chapter 7**

**[Kinetic energy and Work]**

[50 min]

* Define work and kinetic energy.
* State the principle of work-kinetic energy theorem.
* Derive the equation for the work-kinetic energy theorem.
* Calculate the work done by the gravitational force when an object is lifted or lowered.

**Lesson 7**

* Attendance [10 min]

(Continuation of book chapter 7)

* Kinetic energy and Work: [30 min]

(iv) What is spring force?

(v) Derive the expression for the work done by a spring through the displacement of the

spring.

* Problems:1, 9 and 11 (book chapter 7) [to be solved in the class time] [25 min]

* Sample Problem- 7.06 (solved in book chapter 7) - Home work

**Book Chapter 8**

**[Potential Energy and Conservation of Energy]**

[25 min]

* Identify conservative and non-conservative forces.
* Explain the principle of Conservation of Mechanical Energy.

**Lesson 8**

* Attendance [10 min]
* Quiz 2 [20 min]
* Arrangement time for Quiz 2 [10 min]

**Book Chapter 9**

**[Center of Mass and Linear Momentum]**

* **Center of mass:** [20 min]

(i) Define center of mass.

(ii) Given the positions of two particles along an axis, calculate the location of their center

of mass, and apply the equation to determine the velocity of the system’s center of

mass.

* **Define the following terms:** [20 min]

(i) Linear momentum

(ii) Impulse

* Explain the law of conservation of linear momentum. [10 min]

**Lesson 9**

* Attendance [10 min]

(Continuation of book chapter 9)

* Explain the elastic collisions, inelastic collisions, and completely inelastic collisions.

[20 min]

* For isolated elastic collisions in one dimension (**a projectile hitting a stationary target**), apply the conservation laws for both the total kinetic energy and the total linear momentum of the colliding bodies to find the velocities after the collision.

[30 min]

* For isolated elastic collisions in one dimension (**a projectile hitting a moving target**), apply the conservation laws for both the total kinetic energy and the total linear momentum of the colliding bodies to find the velocities after the collision. [*Hints and home task for students*] [5 min]

* Problems: 18, 21, and 49 (book chapter 9) [to be solved in the class time]

[25 min]

Problem: 25 (book chapter 9) [Home task]

**Lesson 10**

* Attendance [10 min]

(Continuation of book chapter 9)

* Problems: 50, 54, 65 (book chapter 9) (to be solved in the class time]

[20 min]

* Problem: 61 [Home task]

**Book Chapter 10**

**[Rotation]**

* Define the following rotational variables: [20 min]

(i) Angular position

(ii) Angular displacement

(iii) Angular velocity

(iv) Angular acceleration

* For constant angular acceleration, write the appropriate kinematic equations. [5 min]
* Derive the relations between the Linear and Angular Variables [20 min]
* Define the rotational inertia of a particle about a point. [5 min]
* Calculate the rotational kinetic energy of a body in terms of its rotational inertia and its angular speed. [10 min]

**Lesson 11**

* Attendance [10 min]
* Quiz 3 [20 min]
* Arrangement time for Quiz 3 [10 min]

(Continuation of book chapter 10)

* Explain Parallel-axis theorem. [Statement with mathematical expression] [10 min]
* A rigid body consisting of two particles of mass m connected by a rod of length L and negligible mass. (i) What is the rotational inertia Icom about an axis through the center of mass, and perpendicular to the rod? (ii) What is the rotational inertia I of the body about an axis through the left end of the rod and parallel to the first axis [**Analytical problem**] [Hints and home task for students; solved in the chapter 10] [5 min]
* **A** thin, uniform rod of mass M and length L, on an X-axis with the origin at the rod’s center. Determine the rotational inertia of the rod about the perpendicular rotation axis through the center. **[Analytical problem]** [20 min]
* Define torque. Apply Newton’s second law for rotation to relate the net torque on a body to the body’s rotational inertia and rotational acceleration, all calculated relative to a specified rotation axis. [15 min]

**Lesson 12**

* Attendance [10 min]

(Continuation of book chapter 10)

* Problems: 5, 6, 11 and 22 (book chapter 10) [to be solved in the class time]

[25 min]

**Book Chapter 11**

**[Rolling, Torque, and Angular Momentum]**

* Calculate the kinetic energy of a body in smooth rolling as the sum of the translational kinetic energy of the center of mass and the rotational kinetic energy around the center of mass. [20 min]
* Define angular momentum. [10 min]
* Explain the law of conservation angular momentum. [10 min]
* Problems:3 and 11 (book chapter 11) [15 min]