Chapter 1

Measurements

By the end of the chapter Student should be able:

1- to identify physical quantities.
2- to differentiate between base quantity and derived quantity.
3- to identify base quantities in Mechanics and their units.
4- to define the International system of units (SI) .
5- to covert between different systems of units using the chain-link conversions.
6- to define the standard of length, time and mass.

Chapter 2

Motion along a Straight Line

By the end of the chapter student should be able:

1- to locate the position of the particle with respect to the origin in one dimension (x or y).
2- to identify the positive direction along x-axis using different word such as (right/east), and negative direction by using words such as (left/west).
3- to identify the positive direction along y-axis using different word such as (up/north), and negative direction by using words such as (down/south).
4- to calculate the displacement in magnitude and determine its direction.
5- to differentiate between displacement and distance.
6- to define velocity in general and to differentiate between velocity and Speed.
7- to define the average velocity and average speed.
8- to calculate the average velocity and its direction.
9- to calculate the average speed.
10- to differentiate between the average velocity and average speed.
11- to define the instantaneous velocity and speed.
12- to calculate the instantaneous velocity and speed.
13- to differentiate between calculating the average velocity and instantaneous velocity from position function at certain time.
14- to differentiate between average and instantaneous velocity.
15- to define the average acceleration.
16- to calculate the average acceleration and determine its direction.
17- to define the instantaneous acceleration.
18- to calculate the instantaneous acceleration from position function or velocity function and determine its direction.
19- to differentiate between average and instantaneous acceleration.
20- to explain motion with constant acceleration.
21- to apply the equations of motion with constant acceleration to solve problems.
22- to define free- fall .
23- to define the acceleration of free fall and its direction when the particle is moving upward or downward.
24- to determine the sign of velocity and displacement of a particle in free fall moving downward and upward.

25- to use the equations of motion with constant acceleration to find the equations of free fall.

26- to apply the equations of free fall to solve problems.

Chapter3

Vectors

By the end of the chapter student should be able:

1- to define vector quantity and scalar quantity and differentiate between them.
2- to add vectors geometrically and write the resultant equation.
3- to identify vector addition properties: commutative law, associative law and vector subtraction.
4- to find the inverse of any vector.
5- to resolve any vector and find its x and y components.
6- to calculate the magnitude and direction of vector.
7- to identify the unit vector (magnitude and direction) on three axes.
8- to write a vector in unit vector notations.
9- to differentiate between scalar and vector components of a vector.
10- to add vectors by components.
11- to multiply vector by scalar (either +ve or - ve no.).
12- to identify the two kinds of multiplication of a vector by another vector.
13- to calculate the scalar product of two vectors in terms of the magnitude of the two vectors and angle between them.
14- to calculate the scalar product of unit vectors.
15- to identify the properties of the scalar product at certain angles (=0,90,180).
16- to calculate the scalar product of two vectors when they are written in unit- vector notation.
17- to define the properties of the scalar product at certain angles (=0,90,180).
18- to calculate the vector product of two vectors in terms of the magnitude of the two vectors and the angle between them, in magnitude and direction.
19- to use the right-hand rule to find the direction of the vector product.
20- to identify the properties of the scalar product at certain angles (=0,90,180).
21- to calculate the vector product of unit vectors.
22- to calculate the magnitude of the vector product of two vectors when they are written in unit-vector notation .

Chapter 4

Motion in two and three dimensions

1. to define the motion in two and three dimension.
2. to locate a particle position in two and three dimension relative to the origin of coordinate system.
3. to calculate the position vector at certain time, in magnitude- direction and write it in unit-vector notation.
4. to calculate the displacement vector in magnitude- direction and write it in unit vector notation.
5. to calculate the average velocity in magnitude- direction and in unit vector notation.
6. to calculate the instantaneous velocity in magnitude- direction and write it in unit vector notation, and specify that the direction is always tangent to the particle's path.
7. to calculate the average acceleration and its direction.
8. to calculate the instantaneous acceleration and its direction
9. .to define the projectile motion.
10. to identify the launched angle of a projectile that measured from the horizontal.
11. to resolve the initial velocity of the projectile into its components and write it in unit-vector notation.
12. to analyze the projectile motion into two one dimensional independent motion: horizontal and vertical motions.
13. to identify the horizontal and vertical components of the acceleration of the projectile.
14. to calculate the horizontal and vertical components of the final velocity of the projectile after time t.
15. to calculate the horizontal and vertical displacement of the projectile after time t.
16. to calculate the maximum height that the projectile can reach.
17. to calculate the time that the projectile spend to reach any position.
18. to define the horizontal Range of the projectile.
19. to calculate the horizontal Range of the projectile.
20. to calculate the maximum horizontal Range of the projectile.
21. to describe the path of the projectile (trajectory).
22. to define the uniform circular motion.
23. to identify the particle's velocity in the uniform circular motion.

24. to define the centripetal acceleration in magnitude and direction for a particle in uniform circular motion.

25. to calculate the time of revolution (period) for a particle in uniform circular motion.

26. to calculate the distance that the particle travels during one period in circular motion.

27. to determine the velocity and acceleration vectors in a circular path in which the centre at the origin of xy plan.

Chapter 5

Force and Motion I

By the end of the chapter student should be able

1- to explain Newton's first law.
2- to define the force and its unit.
3- to resolve forces and find the resultant or net force along x and y axes.
4- to redefine Newton's first law in terms of a net force.
5- to define the mass and its relation to force.
6- to calculate unknown mass from known mass and their accelerations.
7- to explain Newton's second law and the relation between mass , force and acceleration.
8- to relate the net force component along an axis to the acceleration along the same axis.
9- to define Newton (unit) using Newton's second law.
10- to draw free body diagram.
11- to apply Newton's second law in one and two dimension to solve single body problems.
12- to define the gravitational force and write it in unit vector notation and its magnitude and direction.
13- to define the weight and differentiate between mass and weight.
14- to define normal force .
15- to calculate the value of normal force when the object at rest, moving with acceleration, and different situation.
16- to define friction force and its direction.
17- to define tension force and its direction.
18- to calculate the value of tension force when the object at rest, moving with acceleration and different situation.
19- to explain Newton's third law and apply it to different cases.
20- to apply Newton's laws to solve problems for one body or two body System.

Chapter 6

Force and Motion II

By the end of the chapter student should be able:

1- to identify friction force and its cause.
2- to identify the static frictional force.
3- calculate the value of static frictional force.
4- to define the maximum static frictional force and how to calculate it.
5- to identify kinetic friction force and how to calculate it.
6- to define coefficients of static and kinetic friction.
7- to apply Newton's laws including friction force to solve problems.
8- to explain centripetal force in uniform circular motion and its direction.
9- to calculate centripetal force.
10- to identify the nature of centripetal force in different uniform circular motion.

Chapter 7

Kinetic Energy and Work

By the end of the chapter student should be able:

1- to describe the kinetic energy and its relationship with velocity.
2- to calculate the kinetic energy and its unit.
3- to define work and its unit.
4- to identify positive work and negative work.
5- to evaluate the amount of work done by a constant force .
6- to calculate the net work done by several constant forces by two different methods.
7- to identify the work-kinetic energy theorem.
8- to apply the work- kinetic energy theorem to find the relationship between the amount of energy transferred to a body and the net work.
9- to calculate the amount of work done by gravitational force in both raising and falling object.
10- to define a spring force and its relationship with the displacement of a spring.
11- to calculate the spring force from Hooke's law.
12- to evaluate the amount of work done by spring force.
13- to define the power and its unit.
14- to calculate average power and instantaneous power.
15- to calculate the power in terms of force exerted on a body and its velocity.

Chapter 9

Center of mass and Linear Momentum

By the end of the chapter student should be able:

1- to define the center of mass of a system of particles.
2- to calculate the center of mass for two particles in different positions in one dimension.
3- calculate the center of mass for many particles in one dimension.
4- to calculate the center of mass for many particles in two and three dimension.
5- to identify Newton's second law for a system of particles.
6- to apply Newton's second law to a system of particles to calculate the acceleration of center of mass.
7- to define linear momentum and its unit.
8- to derive Newton's second law in terms of momentum.
9- to explain conservation of linear momentum.
10- to apply conservation of momentum to solve problem.