

Mechanics.

Course Level: Grade 12

COURSE DESCRIPTION: Mechanics can be defined as that science which describes and predicts the conditions of rest or motion of bodies under the action of forces. Mechanics curriculum is divided into three parts: mechanics of rigid bodies, mechanics of deformable bodies and mechanics of fluids. The mechanics of rigid bodies is subdivided into statics and dynamics, the former dealing with bodies at rest, the latter with bodies in motion. In this part of the study of mechanics, bodies are assumed to be perfectly rigid.

The principles of mechanics successfully described many other phenomena encountered in the world. Conservation laws involving energy, momentum and angular momentum provided a second parallel approach to solving many of the same problems. In this course, we will investigate both approaches: Force and conservation laws.

Our goal is to develop a conceptual understanding of the core concepts, a familiarity with the experimental verification of our theoretical laws, and an ability to apply the theoretical framework to describe and predict the motions of bodies.

COURSE OBJECTIVES: In this course, you will know and be able to:

STUDY:

Firstly Dynamics:

- 1- Velocity.
- 2- Acceleration (Horizontal Motion).
- 3- Gravity (Vertical Motion).
- 4- Momentum.
- 5- Newton's Law of motion.
 - Newton's First Law.
 - Newton's Second Law.
 - Newton's Third Law.

Secondly Statics:

- 1- Equilibrium.
- 2- Friction.
- 3- Equilibrium of a particle on Rough Inclined Plane.
- 4- Resultant of Two parallel forces.
- 5- Resultant of more than two parallel coplanar forces.
- 6- Equilibrium of coplanar parallel forces.

Explanation of Topics

Firstly Dynamics:

- 1- Velocity.

- The purpose of this lesson to learn the rectilinear motion of a moving particle, analyzing this motion, and studying the vectors of the position displacement and velocity.

-Use the related time to express the velocity if the displacement is a function of time ($v = ds/dt$).

By the end of this chapter, the student should be able to:

- To solve any example or story problem using the key terms:

Rectilinear Motion, Position, Displacement, Distance, Average Velocity, Average Speed, Velocity and Speed.

2- Acceleration (Horizontal Motion).

- The purpose of this lesson to Use the related time to express the acceleration, if the velocity is a function of time ($a = dv/dt$)

-Express the acceleration as a function of the displacement if the velocity is a function of the displacement ($a = v dv/ds$)

By the end of this chapter, the student should be able to solve any example or story problem Using the key terms:

Average Velocity, Average Speed, Velocity, Speed, Average Acceleration, Acceleration.

3- Gravity (Vertical Motion).

- The purpose of this lesson to identify the center of gravity of a rigid body.

- Identify the relation among the weight of a body, the center of gravity, Equilibrium and the gravity.

- Identify the center of gravity of a system of particles.

-By the end of this lesson and by doing all the activities involved, the student should be able to:

-Identify the position vector of the center of gravity for a rigid body about the origin point.

-solve any problem about Vertical motion under gravity.

-solve any problem concerning equations of vertical motion.

4- Momentum.

- We use the term momentum in various ways in everyday language. We speak of sports teams gaining and maintaining the momentum to win. Generally, momentum implies a tendency to continue on course - to move in the same direction - and is associated with mass and velocity. Momentum has its most important application in analyzing collision problems, and, like energy, is important because it is conserved. Only a few physical quantities are conserved in nature, and studying them yields fundamental insight into how nature works, as we shall see in our study of momentum.

5- Newton's Law of motion.

-Newton's First Law.

-Newton's Second Law.

-Newton's Third Law.

- The purpose of this lesson to Identify Newton's law of Motion. And to solve story problems about Newton's law of Motion.

- By the end of this chapter, the student should be able to:

- To solve and example or story problem Using the key terms:

Newton's first law, Inertia, Inertia principle, Force, Newton's second law, Equation of motion, Weight, Newton's third law, Pressure, Reaction and Lift motion.

Secondly Statics:

1- Equilibrium.

The purpose of this lesson to determine the conditions of equilibrium of a body and to solve the equilibrium equation using forces acting on the particle.

2- Friction.

- The purpose of this lesson to distinguish the smooth surfaces and rough surfaces.
- Identify the concept and properties of friction.
- Identify the friction force and the limiting friction force.
- Determine the coefficient of the friction, angle of friction and the relation between them.

3- Equilibrium of a particle on Rough Inclined Plane.

- The purpose of this lesson to determine the conditions of equilibrium of a body on a rough inclined plane. And also to deduce the relation between the measure of the angle of friction and the measure of the angle of inclination of the plane on the horizontal as a body is placed on a rough inclined plane on a condition the body is about to slide under the effect of its weight only.
- Solve life applications on the friction.
- Also, the student should be able to solve any example or story problem using the key terms: Friction, Smooth Surface, Rough Surface, Reaction Normal, Static Frictional force, Kinetic Frictional force, Limiting Static Friction, Resultant Reaction, Angle of Friction, Rough horizontal plane, Rough inclined plane.

4- Resultant of Two parallel forces.

- The purpose of this lesson to identify one of the two parallel forces if the other force and the resultant are known. Find the moments of a system of parallel coplanar forces about a point
- Also, the student should be able to solve any example or story problem.

5- Resultant of more than two parallel coplanar forces.

- The purpose of this lesson to find the resultant of a system of parallel coplanar forces.
- Deduce that the sum of the moments of a system of parallel forces about a point is equal to the moment of the resultant about the same point.
- Also, the student should be able to solve any example or story problem.

6- Equilibrium of coplanar parallel forces.

- The purpose of this lesson to deduce that the sum of the moments of a system of parallel forces about a point is equal to zero if their resultant passes through such a point.
- Deduce that the sum of the moments of a system of parallel forces about a point is equal to zero if the resultant of these forces vanishes.
- Also, the student should be able to solve any example or story problem using the key terms: Reaction, Weight, Parallel, Support and Beam.

COURSE EVALUATION

Quarter Grades:

40%: Final Exam

15%: weekly quizzes

15%: Assignments

15%: Projects

15%: Attendance or Classwork