COURSE NUMBER: PH1100

COURSE TITLE: Physics

COURSE DESCRIPTION:

This is an introductory physics course designed to extend the students' knowledge and understanding of basic physics principles, concepts and applications related to mechanics. The course also extends abilities in data handling, problem solving and experimentation.

PREREQUISITES: None

CO-REQUISITES: None

CREDIT VALUE: Four (4)

COURSE HOURS PER WEEK: Three (3)

LAB HOURS PER WEEK: Two (2) (NL only)
Three (3) (Qatar only)

SUGGESTED TEXT:

One of

Walker, J.S. (2009). *Physics with Mastering Physics and study guide and selected solutions manual for physics* (4th ed.). Addison Wesley. ISBN-10: 0132558823; ISBN-13: 978-0132558822 (ebook created for College of the North Atlantic)

Cutnell, J. D., & Johnson, K. W. (2012). *Physics* (9th ed.). New Jersey: Wiley & Sons. ISBN 13: 9780470879528

and

College of the North Atlantic (Current edition). *Physics laboratory manual.*

or

Wilson, J.D., Buffa, A.J., & Lou, B. (2010). *College physics with Mastering Physics* (7th ed.). Addison-Wesley. ISBN 10: 0321571118; ISBN 13: 9780321571113

or

Giancoli, D. (2005). *Physics: Principles with applications* (6th ed.). Prentice Hall. ISBN 10: 0-13-060620-0; ISBN 13: 9780130606204

LEARNING RESOURCES: To be determined by instructor

MAJOR TOPICS:

1.0 The Nature of Physics
2.0 Describing Motion; Kinematics in One Dimension
3.0 Kinematics in Two Dimensions: Vectors
4.0 Motion and Force: Dynamics
5.0 Circular Motion: Gravitation
6.0 Bodies in Equilibrium
7.0 Work and Energy
8.0 Linear Momentum

LEARNING OBJECTIVES:

The expected learning outcome is that the student will be able to:

1.0 The Nature of Physics

1.1 The practice of science
- 1.1.1 Distinguish between scientific facts and theories
- 1.1.2 Explain the use of the scientific method in the study of physics

1.2 Physics and its relation to other fields
- 1.2.1 Explain the relationship of physics to the other basic sciences

1.3 Models, theories and laws
1.4 Measurement and uncertainty
1.5 Standards and units: the S.I.
- 1.5.1 List the fundamental units of length, mass and time in the S.I.
- 1.5.2 Give five examples of derived units in the S.I.

2.0 Describing Motion: Kinematics in One Dimension

2.1 Speed
- 2.1.1 Define speed
- 2.1.2 Calculate the average speed of an object

2.2 Reference frames and co-ordinate systems
- 2.2.1 Locate a point by using a rectangular co-ordinate system
- 2.2.2 Give examples of different reference frames

2.3 Conversion of units

2.3.1 Convert the values of physical quantities within the S.I. *(e.g., km/h to m/s)*
2.3.2 Solve problems involving dimensional analysis

2.4 Linear velocity: displacement
2.4.1 Define displacement and linear velocity
2.4.2 Distinguish between displacement and distance
2.4.3 Distinguish between velocity and speed
2.4.4 Calculate the average velocity of an object

2.5 Instantaneous velocity
2.5.1 Define instantaneous velocity
2.5.2 Distinguish between instantaneous velocity and average velocity

2.6 Vector and scalar quantities
2.6.1 Define vector quantities
2.6.2 Define scalar quantities
2.6.3 Give examples of vector quantities and scalar quantities

2.7 Acceleration
2.7.1 Define acceleration
2.7.2 Calculate the average acceleration of an object

2.8 Uniformly accelerated motion
2.8.1 Write the equations of motion for an object undergoing uniformly accelerated motion
2.8.2 Calculate the displacement, acceleration, initial and final velocities of an object undergoing uniformly accelerated motion

2.9 Problem solving
2.9.1 Describe techniques and hints for problem solving

2.10 Acceleration under the action of gravity
2.10.1 Explain Galileo's postulate
2.10.2 Calculate the position and velocity of an object moving freely in a vertical path, given initial conditions of position, velocity and time
2.10.3 Explain the terms "air friction" and "terminal velocity"

2.11 Graphical analysis of linear motion
2.11.1 Describe linear motion by graphical analysis

3.0 Kinematics in Two Dimensions: Vectors

3.1 Addition and subtraction of vector quantities
3.1.1 Add or subtract two vector quantities whose directions are at 0, 180, 90, with respect to each other
3.1.2 Add two vector quantities using the parallelogram method

3.1.3 Add two or more vectors by the polygon method
3.1.4 Add or subtract two or more vectors using the law of cosines and the law of sines
3.1.5 Add or subtract two or more vectors using the component method

3.2 Relative velocity
3.2.1 Add or subtract the velocities of several moving objects within a fixed reference frame

3.3 Projectile motion
3.3.1 Determine the horizontal and vertical position of a projectile given its initial velocity
3.3.2 Determine the time after its release it will attain any horizontal or vertical distance given
3.3.3 Determine the distance and time it will intersect a given horizontal surface

4.0 Motion and Force: Dynamics

4.1 Force
4.1.1 Define force and give examples of forces

4.2 Newton's first law of motion
4.2.1 State in words and by practical example the principle of inertia

4.3 Mass
4.3.1 Explain the concept of mass in terms of Newton's first law

4.4 Newton's second law of motion
4.4.1 State in words, and by practical example, Newton's second law of motion
4.4.2 Calculate the force required to produce an observed acceleration of an object of given mass

4.5 Newton's third law of motion
4.5.1 State in words and by practical example the meaning of an action-reaction pair of forces
4.5.2 Given a force, determine its appropriate reaction force

4.6 Weight: The force of gravity
4.6.1 Explain the difference between the mass of an object and its weight
4.6.2 Determine the weight of a given mass at the earth's surface
4.6.3 Determine the mass of a given weight at the earth's surface

4.7 Applications of Newton's Laws: Vector Forces
4.7.1 Apply Newton's Laws to problems involving the motion of an object or system of objects when a number of vector forces are acting
4.7.2 Analyze the forces acting on an object resting or moving on an inclined

plane

4.8 Friction
- 4.8.1 Distinguish between static friction and kinetic friction
- 4.8.2 Determine the coefficient of friction between two surfaces from given forces and masses
- 4.8.3 Apply the appropriate value of the coefficient of friction to determine the magnitude of the frictional force

5.0 Circular Motion: Gravitation

5.1 Uniform Circulation Motion
- 5.1.1 Define centripetal acceleration and centripetal force
- 5.1.2 Determine the speed and/or acceleration of an object moving in uniform circular motion from its period of motion and the radius of its motion

5.2 Newton's Law of Universal Gravitation
- 5.2.1 State the Law of Universal Gravitation
- 5.2.2 Solve simple two-body problems involving the law

5.3 Gravity near the Earth's surface
- 5.3.1 Calculate the acceleration caused by the earth at a given point in space above the earth's surface

5.4 Satellites and "Weightlessness"
- 5.4.1 Explain why a satellite is capable of staying in orbit
- 5.4.2 Calculate the velocity and orbital radius for an object moving in a circular orbit

6.0 Bodies in Equilibrium

6.1 Statics: The conditions for Equilibrium
- 6.1.1 State the first condition for equilibrium and the second condition for equilibrium in words and mathematically
- 6.1.2 Apply the conditions of equilibrium to problems involving, firstly, a particle and, secondly, a rigid body

6.2 Simple machine: levers and pulleys
- 6.2.1 Explain the operation of the lever and pulley
- 6.2.2 Solve simple problems involving levers and pulley systems

6.3 Stability and balance
- 6.3.1 Use examples to explain objects in stable, unstable and neutral equilibrium

7.0 Work and Energy

7.1 Work done by a constant force
- 7.1.1 Define work
- 7.1.2 Calculate the work done by a given force acting on a body through a specified displacement

7.2 Kinetic energy and the work energy theorem
- 7.2.1 Define kinetic energy
- 7.2.2 State the work energy theorem
- 7.2.3 Calculate the kinetic energy of specified objects moving at a given speed
- 7.2.4 Apply the work-energy theorem to problems with and without non-conservative forces acting

7.3 Potential energy
- 7.3.1 Define potential energy
- 7.3.2 Calculate gravitational potential energy of objects
- 7.3.3 Calculate the elastic potential energy of spring like systems from the spring constant and displacement

7.4 The law of conservation of energy
- 7.4.1 State the law of conservation of energy
- 7.4.2 Solve simple problems involving potential - kinetic energy transformations

7.5 Power
- 7.5.1 Define power
- 7.5.2 Solve simple problems involving the expending of energy over a time interval

8.0 Linear Momentum

8.1 Momentum and force
- 8.1.1 Define linear momentum

8.2 Conservation of momentum
- 8.2.1 State the law of conservation of momentum

8.3 Impulse: collisions
- 8.3.1 Define impulse
- 8.3.2 Determine the change in momentum from the impulses
- 8.3.3 Solve simple problems involving the momentum of a two body system during collision

8.4 Conservation of energy and momentum in collisions
- 8.4.1 Distinguish between elastic and inelastic collisions
- 8.4.2 Solve simple problems involving the conservation of energy and momentum during collisions

8.4.3 Solve problems involving collisions in two dimensions

8.5 Center of mass
- 8.5.1 Explain the concepts "centre of mass" and "centre of gravity"
- 8.5.2 Calculate the position of the centre of mass of a system of bodies

LABS/SEMINARS:

1. Measurement
2. Triangulation
3. Density of a solid
4. Equilibrium of concurrent forces
5. Kinetic friction
6. Torque and equilibrium
7. Acceleration due to gravity
8. Energy
9. Projectile motion and conservation of energy
10. The simple pendulum
11. Determination of diameter of molecules
12. Centripetal force
13. Momentum

EVALUATION:

Semester Examinations	30%
Assignments	10%
Laboratory Reports	10%
Final Examination	50%

If a student misses a laboratory session *without a valid documented reason***, a mark of 0 for that lab will be assigned. In order to be eligible to write the final examination (including a supplementary final examination) and pass the course, students must pass (minimum of 50%) the essential laboratory component of the course. A student who misses more than 3 labs without valid documentation will be required to drop the course. Please note that dropping the course without academic prejudice must be done within established College processes and time frames.
** What would be considered as a "valid documented reason" will be at the discretion of the campus administrator in consultation with the faculty responsible for this course.

DATE DEVELOPED:	June 1998	**DATE REVIEWED:**	February 2014
REVISION NUMBER:	5	**DATE REVISED:**	July 2012

Note to instructor: Check PIRS to ensure this outline is the most current version.