HAJEE MOHAMMAD DANESH SCIENCE & TECHNOLOGY UNIVERSI

B.Sc. in CSE, Level-1, Semester-I; Final Examination-2019 (Jan-Jun); Course Code: PHY 1

Course Title: Physics (Electricity, Magnetism, Optics, Waves and Oscillation)

Time: 3.00 Hours | Full Marks: 90

*(Answer any three out of each section & use separate script for answering each section.)*

## SECTION-A

1. (a) What is the source of charge? 3
   (b) State and explain Coulomb's law. 7
   (c) A hydrogen atom consists of a single proton and a single electron. The proton has a charge of $+e$ and the electron has $-e$. In the 'ground state' of the atom, the electron orbits the proton at most probable distance of $5.29 \times 10^{-11}$ m. Calculate the electric force on the electron due to the proton. What would be different if the electron also had a positive charge? 5

2. (a) Define electric field. 3
   (b) Find the magnitude and direction of electric field at a distance $z$ above the midpoint between two equal charges $+q$ that are a distance $d$ apart. 7
   (c) In an ionized helium atom, the most probable distance between the nucleus and the electron is $r=26.5 \times 10^{-12}$ m. What is the electric field due to the nucleus at the location of the electron? 5

3. (a) Define electric dipole and electric dipole moment. 3
   (b) Describe the rotation of an electric dipole due to an electric field. 7
   (c) If $1.80 \times 10^{20}$ electrons move through a pocket calculator during a full day's operation, how many coulombs of charge moved through it? 5

4. (a) Would defining the charge on an electron to be positive have any effect on Coulomb's law? 5
   (b) Two charges lie along the $x$-axis. Is it true that the net electric field always vanishes at some point (other than infinity) along the $x$-axis? 5
   (c) Suppose Earth and the Moon each carried a net negative charge $-Q$. Approximate both bodies as point masses and point charges. What value of $Q$ is required to balance the gravitational attraction between Earth and the Moon? 5

## SECTION-B

1. (a) Define the concept of electric flux. 3
   (b) State and explain Gauss's law. 7
   (c) A sphere of radius $R$, such as that has a uniform volume charge density $\rho_0$. Find the electric field at a point outside the sphere and at appoint inside the sphere. 5

2. (a) Discuss how potential difference and electric field strength are related. Give an example 3
   (b) Find the electric potential of a uniformly charged, non-conducting wire with linear density $\lambda$ (coulomb/meter) and length $L$ at a point that lies on a line that divides the wire into two equal parts 7
   (c) How far from a $1.00 \times 10^{-6}$ C point charge is the potential 100 V? At what distance is it $2.00 \times 10^{2}$ V? 5

3. (a) What is simple harmonic motion? 3
   (b) Derive the differential equation of simple harmonic motion and find its solution. 7
   (c) Find the expression of total energy of simple harmonic oscillator. 5

4. (a) Define wave 2
   (b) Discuss the various types of waves. 7
   (c) A wave is modeled by the following wave function: 6

$$y(x,t) = (0.30m)\sin[\frac{2\pi}{4.50m}(x - 18.00\frac{m}{s}t)]$$

What are the amplitude, wavelength, wave speed, period, and frequency of the wave?

# HAJEE MOHAMMAD DANESH SCIENCE & TECHNOLOGY UNIVERSITY

**B.Sc. in CSE, Level-1, Semester-I**

**Final Semester Examination-2018(Jan-Jun)**

**Course Title: Engineering Physics**

**Course Code: PHY 103 Course Credit: 3.0**

**Time: 3.00 hours** **Full Marks: 90**

*(Answer any three out of each section)*

*The figures in the right margin indicate full marks for the respective questions.*

*Use separate script for answering each section.*

## SECTION-A

| | | | |
|---|---|---|---|
| 1. | (a) | State and explain Coulomb's law. | 3 |
| | (b) | Find an expression of electric field due to a long straight uniformly charged wire. | 7 |
| | (c) | Calculate the repulsive force between two protons in a helium nucleus. Assume a separation of $1.5 \times 10^{-15}$ m between them. | 5 |
| 2. | (a) | Define electric field and equipotential surface. | 3 |
| | (b) | Deduce an expression of electric potential at a point due to a dipole. | 7 |
| | (c) | Why does an electric dipole experience a torque in an external electric field? | 5 |
| 3. | (a) | State and explain Gauss' law. | 3 |
| | (b) | Deduce Coulomb's law from Gauss' law. | 7 |
| | (c) | What happens if an electric field is parallel to the Gaussian surface at all points? | 5 |
| 4. | (a) | Write the differences between electric current and current density? | 3 |
| | (b) | State and explain Ohm's law. | 7 |
| | (c) | A nickel wire of length one meter and diameter 0.55 cm has resistance $2.87 \times 10^{-3}$ ohms. If an e.m.f of one volt is applied between the two ends of the wire, calculate (i) current through the wire, (ii) current density and (iii) the electric field strength. | 5 |

## SECTION-B

| | | | |
|---|---|---|---|
| 1. | (a) | Define electromotive force. | 2 |
| | (b) | State and explain Kirchhoff's law of electric circuit analysis. | 8 |
| | (c) | A metal rod of length 20.3 cm, has resistance $85 \times 10^{-6}$ ohms. If the diameter of the rod is 0.5 cm, calculate the resistivity of the metal. | 5 |
| 2. | (a) | What is magnetic field? | 2 |
| | (b) | Obtain an expression of magnetic field at a point due to a long straight current carrying wire. | 8 |
| | (c) | Find the force between two parallel wires, 100 cm long, 2 cm apart, and carrying a current of 20 amp. | 5 |
| 3. | (a) | Define simple harmonic motion. | 3 |
| | (b) | Derive an equation of simple harmonic motion and hence define angular frequency. | 7 |
| | (c) | Discuss an application of simple harmonic motion. | 5 |
| 4. | (a) | What is wave? | 2 |
| | (b) | Discuss the types of waves. | 8 |
| | (c) | Write a short note on principle of superposition of waves. | 5 |

# Hajee Mohammad Danesh Science and Technology University, Dinajpur

B.Sc. in CSE, Level-1 Semester-I, Final Semester Examination-2017 (January-June)

Course Title: Mechanics; Waves and Optics; Course Code: PHY 103

Total Marks: 90 Credit hour: 3.0 Time: 3 hours

**USE SEPARATE SCRIPT FOR ANSWERING EACH SECTION**

**Answer any three questions from each section**

## SECTION-A

| | | | |
|---|---|---|---|
| 1. | (a) | Define waves. How does a wave transfer energy? | 2+2 |
| | (b) | Classify waves with examples. | 7 |
| | (c) | State the basic properties of waves. | 4 |
| 2. | (a) | What is wave speed? Does frequency affect wave speed? | 2+2 |
| | (b) | Describe the factors affecting wave speed. How does wave energy work? | 4+3 |
| | (c) | Calculate the velocity of a water wave if the frequency is 400 Hz, the wavelength is 6 m, and the amplitude of the wave is 3.76 cm. | 4 |
| 3. | (a) | State the principle of superposition of waves. | 2 |
| | (b) | Deduce the equation of a progressive wave. | 7 |
| | (c) | The equation of a wave propagating along a stretched string is given by $Y = 4\ sin\ 2\pi\ [(t/0.02) - (x/100)]$, where $y$ and $x$ are in cm and $t$ in second. Determine: (i) direction in which wave is propagating, (ii) amplitudes, (iii) time period, (iv) frequency, (v) angular frequency, (vi) wavelength, (vii) propagation constant, and (viii) velocity of wave. | 6 |
| 4 | (a) | How does the diffraction differ from interference? | 4 |
| | (b) | Explain the theory of Fraunhofer diffraction pattern due to a single slit. | 7 |
| | (c) | Light of wavelength 6000 Å is incident on a narrow slit. The screen is placed 2 m away from the slit. If the first minima lie 5 mm on either side of the central maximum, calculate the slit width. | 4 |

## SECTION-B

| | | | |
|---|---|---|---|
| 1. | (a) | What is photon? | 3 |
| | (b) | Describe corpuscular theory and electromagnetic theory of light. | 3+3 |
| | (c) | State the difference between coherent and incoherent light. The red light from a helium-neon laser has a wavelength of 633 nm. What is the energy of one photon? | 3+3 |
| 2. | (a) | Explain interference of light waves. | 4 |
| | (b) | Give the mathematical interpretation of superposition of two light waves. | 7 |
| | (c) | In Young's double slit experiment the separation of the slits is 1.9 mm and the fringe spacing is 0.31 mm at a distance of 1 m from the slits. Calculate the wavelength of light. | 4 |
| 3. | (a) | State the law's of reflection of light. | 3 |
| | (b) | Explain Huygens' principle and deduce the laws of refraction from it. | 8 |
| | (c) | A light ray strikes a reflective plane surface at an angle of 56° with the surface. Find, (i) the angle of incidence, (ii) the angle of reflection, (iii) the angle made by the reflected ray and the surface, and (iv) the angle made by the incident and reflected rays. | 4 |
| 4 | (a) | What is sound wave? Is sound a transverse wave? | 4 |
| | (b) | Give the analytical treatment of stationary waves. | 7 |

**HAJEE MOHAMMAD DANESH SCIENCE & TECHNOLOGY UNIVERSITY, DINAJPUR**

B.Sc. in CSE Level 1 Semester I Examinations 2016

Course Title: Physics-I (Mechanics, Waves and Optics)

Course Code: PHY 103 Credit Hours:3

Full Marks: 90 (45 for the section-A & 45 for the section- B) Time: 3 Hours

The figures in the right margin indicate the full marks for respective question.

USE SEPERATE SCRIPTS FOR ANSWERING EACH SECTION.

## SECTION 'A'

Answer any five.

1 (a) Define uniform circular motion. Deduce the expression, $\vec{a} = -\hat{u}_r \frac{v^2}{r}$. 7

(b) In Bohr's model of the hydrogen atom an electron revolves around a proton in a circular orbit of radius $5.28 \times 10^{-11}$ m with a speed of $2.18 \times 10^{6}$ ms$^{-1}$. Find the centripetal force acting on the electron. 2

2 (a) Define and explain impulse of a force. 3

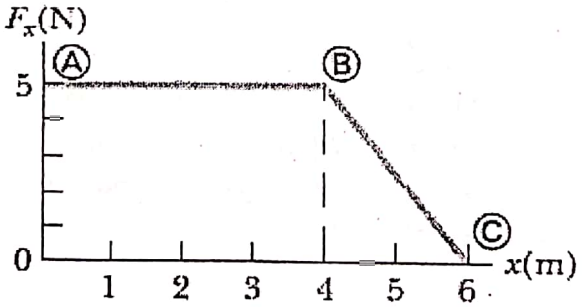
(b) Show that in one-dimensional elastic collision of two particles of equal masses the particles simply exchange their velocities. 6

3. (a) Define simple harmonic motion. 2

(b) The equation of motion of a simple harmonic oscillator is given by $\frac{d^2x}{dt^2} + \frac{k}{m}x = 0$ .Show that period of oscillation of such an oscillator is $T = 2\pi\sqrt{\frac{m}{k}}$ 7

4. (a) Show that the work done by a varying force $F_x$ in displacing a body from $x_i$ to $x_f$ is $W = \int_{x_i}^{x_f} F_x dx$. 6

(b) A force acting on a particle varies with $x$, as shown in Figure. Calculate the work done by the force as the particle moves from x =0 to $x$=6.0 m.




3

5. (a) Derive the equation of a standing wave. What are the conditions for nodes and antinodes? 6

(b) A string is stretched with a force of 100N. Its linear mass density is $0.1 kg.m^{-1}$. One end of the string is oscillating with amplitude of $0.01m$ and frequency 400Hz so that traveling waves are up in the positive x-direction. Calculate the velocity and wavelength of the waves. 3

6. (a) Write down kepler's law of the motion of planets and satellites. Derive the law of areas. 7

(b) A projectile is fired vertically from the earth's surface with an initial speed of 9.42 km/s. Neglecting the atmospheric friction, how far above the earth's surface will it go? (Mass of the earth is $5.98 \times 10^{24} kg$.) 2

7. (a) State and explain Malus law. 6

(b) Write short note on the double refraction. 3

## SECTION 'B'

Answer any five.

1. (a) What is Doppler effect? Deduce an expression for the frequency of sound heard by an observer, moving toward a stationary source at a speed of $v_o$. 6

(b) As an ambulance travels east down a highway at a speed of 33.5 m/s, its siren emits sound at a frequency of 400 Hz. What frequency is heard by a person in a car traveling west at 24.6 m/s (i) as the car approaches the ambulance and (ii) as the car moves away from the ambulance? 3

2. (a) Define cross product of two vectors $\vec{A}$ and $\vec{B}$. 3

(b) If $\vec{A} = 2\hat{i} + \hat{j} - 3\hat{k}$ and $\vec{B} = \hat{i} - 2\hat{j} + \hat{k}$ find a vector of magnitude 9 perpendicular to both $\vec{A}$ and $\vec{B}$. 4

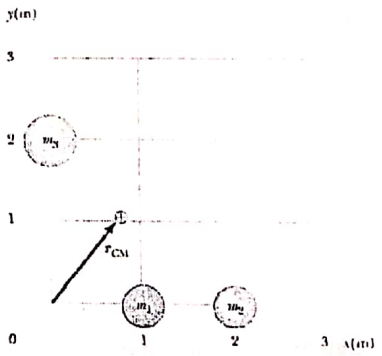
(c) A particle moving in the xy plane undergoes a displacement $\vec{d} = (2\hat{i} + 3\hat{j})$ m and a constant force $\vec{F} = (5\hat{i} + 2\hat{j})$ N acts on the particle. Calculate the work done by $\vec{F}$. 2

3. (a) Define torque and angular momentum. 4

(b) Calculate the moment of inertia of an annular cylinder about the cylinder axis. 5

4. (a) Discuss conservative force and non- conservative force with examples. 5

(b) A system consists of three particles located as shown in Figure, with $m_1 = m_2 = 1.0kg$ and $m_3 = 2.0kg$, where y and x are expressed in meters. Find the center of mass of the system.




4

5. (a) What is elastic and inelastic collision? Show that conservation of momentum holds during collision. 7

(b) By what friction is the kinetic energy of a neutron (mass $m_1$) decreased in head-on elastic collision with the atomic nucleus (mass $m_2$) initially at rest? 2

6. (a) Show that the total mechanical energy in the planetary and the satellite motion is $E = -\frac{GMm}{2r}$. 7

(b) At what altitude above the Earth's surface is the free-fall acceleration equal to $7.35 m/s^2$ (three-quarters of its value at the surface)? 2

7. Write short notes on any 3: (i) Scattering of light, (ii) dispersion of light, (iii) total internal reflection and (iv) refractive index and optical path. 9

**HAJEE MOHAMMAD DANESH SCIENCE & TECHNOLOGY UNIVERSITY, DINAJPUR**

B.Sc in CSE, Level -1, Semester- II, Examination-2015 (July-Dec)

Course Code: PHY 107, Course Title: Physics II (Electricity, Magnetism and Modern Physics)

Full Marks: 90 (45 for section-A & 45 for section-B), Time: 3 hours

*The figures in the right margin indicate the full marks for respective question*

USE SEPERATE SCRIPT FOR ANSWERING EACH SECTION

## SECTION-A

**(Answer any Three)**

1(a) Define electric field and electric flux. 3

(b) What are limitations of Coulomb's law? Compare between gravitational force and Coulomb's force. 7

(c) A hypothetical cylinder of radius R immerged in a uniform electric field $\vec{E}$. The cylinder axis is parallel to the field. Calculate electric flux for this closed surface. 5

2(a) What are electric field lines? Discuss the relationship between electric field and lines of forces. 5

(b) Define an electric dipole. Calculate electric field strength due to an electric dipole. 6

(c) An electric dipole consist of two opposite charges of magnitude $q=1.0\times10^{-6}$ separated by a distance 2.0cm. The dipole is placed in an field of $1.0\times10^{5}\,NC^{-1}$. (i)What maximum torque does the field exert on the dipole? (ii) How much work must an external agent do to turn the dipole from its initial alignment given by $\theta_0=0^0$ to final alignment $\theta=90^0$. 4

3(a) Establish the differential form of Gauss's law and explain it in vacuum. 4

(b) What is electric potential? Derive electric potential due to a point charge. 7

(c) The wavelength of the first number of Balmer series of hydrogen is $6.63\times10^{-10}$m. Calculate the wavelength of its second number. 4

4(a) What is mean by the term radioactivity? Write the main difference between a beta electron and an ordinary electron. 2

(b) What is binding energy of a nucleus? Calculate the binding energy of ${}^{3}_{2}He$. 4

(c) Define activity and derive the decay equation using radioactive decay law. 6

(d) A radioactive substance has a half-life period of 30 days. Calculate time taken for ¾ of the original number of atoms to disintegrate 3

## Section-B

Answer any 3 (**Three**) questions

1. a) Define primitives. Find the primitives of $(3+2\sin x+\cos x)dy=(1+2\sin y+\cos y)dx$ 5

   b) Solve the differential equation $(xy+2x+y+2)dx+(x^2+2x)dy=0$ 5

   c) Find the solution of $(x\sqrt{x^2+y^2}-y^2)dx+xydy=0$ 5

2. a) State Bernoulli's theorem. Find the solution of $\frac{dy}{dx}+y=xy^3$ 5

   b) Solve the initial value problem 5
   $(2x\cos x+3x^2y)dx+(x^3-x^2\sin y-y)dy=0\ ;y(0)=2$

   c) Test exactness and solve the differential equation 5
   $(x^2y-2xy^2)dx-(x^3-3x^2y)dy=0$

3. a) Find the complimentary function and particular integral of 5
   $(D^3-3D^2+4D-2)y=e^x+\cos x$

   b) Solve the simultaneous differential equations $\frac{dx}{dt}+4x+3y=t\ ;\frac{dy}{dt}+2x+5y=e^t$ 5

   c) Form the partial differential equation by eliminating arbitrary function 5
   $\varphi(x^2+y^2+z^2,z)=0$

4. a) Solve the partial differential equation $x(y^2-z^2)p+y(z^2-x^2)q=z(x^2-y^2)$ 5

   b) Apply charpit's method to find the solution of $2xz-px^2-2qxy+pq=0$

   c) Solve the partial differential equation $(D_x^3+D_x^2D_y-6D_xD_y^2)z=x^2+y^2$