Tribhuwan University
Institute of Science and Technology
2066

Bachelor Level / First Semester / Science — Full marks: 60
Computer Science and Information Technology(PHY113) — Pass marks: 24
((TU CSIT) Physics) — Time: 3 hours
Candidates are required to give their answers in their own words as far as practicable.
The figures in the margin indicate full marks.

Section A:

Attempt any four questions:

1. Write the law of conservation of momentum and the law of conservation of energy. Write Galilean transformation. Show that the laws of conservation of momentum and of conservation of energy are invariant under Galilean transformation. (2+1+4)

2. Write and explain Bernoulli's theorem giving two practical examples. Deduce Bernoulli's equation. (1+2+2+2)

3. (a) Given the sum of external forces acting upon a system of particles equals zero, show that the total angular momentum remains constant.

(b) Write Gauss's law for a system of charges in vacuum. Modify this law for the case when the some charges are in medium of dielectric constant K. (1.5+2)

4. Derive the expression for energy density in electric field. (7)

5. Derive Δx E$\rightarrow$ = _ – which constitutes one of the Maxwell's equation. (7)

Section B:

Attempt any eight questions:

6. Calculate the magnitude of centripetal force acting on a mass 100g placed at a distance 0.2m from the center of a rotating disk with 200 rpm. (4)

7. Given g = 9.81 ms^2 , radius of earth = 6.38 x 10^6 m and gravitational constant (G=6.6 x 10^{-11} m^3 Kg s^{-2}. Calculate the mass of the earth and time of revolution of a satellite in a circular orbit near the earth surface. (2+2)

8. A charged particle moving along x — axis enters a region in which a constant electric field is along y — axis and a constant magnetic field is along z — axis. What is the condition that the net force acting on the charge is zero? (4)

9. A particle in Simple Harmonic Motion. Show that the total energy of the particle is constant. (4)

10.In an experiment with Poiseuille's apparatus the volume of water coming out per second is 8 cm3 through a tube of length 0.62 m and of uniform radius 0.5 mm. The pressure difference between the two ends of the tube is equal to 3.1 cm of Hg. You can use the Poiseuille's formula to calculate the coefficient of viscosity $Q=\frac{\pi r^4 p}{8\eta l}$ **(4)**

11. Two point charges have charge q1= 2.0 x 10^{-8} C and q2=-0.7 x 10^{-8} C respectively. The charges are placed 2 cm apart. Find force between the charges. (4)

12. An electron having kinetic energy 3.0 x 10^{-17} J enters a region of space containing a uniform electric field E = 800 vm^{-1} . The field is parallel to the electron's velocity and decelerates it. How far does the electron travel before it comes to rest? (4)

13. A straight metal wire of length l is moved in a magnetic field $\vec{B}$ **with velocity** $\vec{v}$ **. Consider the Lorentz force acting electrons in the wire and show that the potential difference across the wire is** $\vec{B}, \vec{l}, \vec{v}$ **(4)**

14.A capacitor C, a resistor R and a battery arc connected in series with a switch. The switch is closed at time t = 0. Set up the differential equation governing charge on the capacitor and find the charge as a function of time. (4)

15. Calculate the energy density of uniform magnetic field of strength 1 Tesla in Vacuum [$\mu 0 = 4\pi \times 10^{-7}$h/n] (4)