

Bachelor of Science (B.Sc.) Semester-II (C.B.S.) Examination
PHYSICS (GRAVITATION, ASTROPHYSICS, MAGNETISM AND MAGNETOSTATICS)
Compulsory Paper—2

Time : Three Hours]

[Maximum Marks : 50

N.B. :- (1) All questions are compulsory.
 (3) Draw neat diagrams wherever necessary.

1. EITHER

- (A) State and explain Kepler's laws of planetary motion. Show that the square of time period of revolution of a planet is proportional to the cube of semi-major axis of the orbit. 5
- (B) (i) Obtain an expression for gravitational potential due to a point mass. 3
 (ii) Calculate the gravitational potential due to a point mass of 400 kg. at a distance of 5.0 m, if $G = 6.7 \times 10^{-11} \text{ Nm}^2/\text{kg}^2$. 2

OR

- (C) Obtain an expression for intensity of gravitational field due to a solid sphere at a point outside the sphere. $2\frac{1}{2}$
- (D) Derive Newton's law of gravitation from Kepler's laws. $2\frac{1}{2}$
- (E) Show that the gravitational flux enclosed by the closed surface is $\phi = - 4\pi \text{ G.M.}$ $2\frac{1}{2}$
- (F) What is the gravitational potential of a body of mass 0.2 kg at a height of 1600 km above the surface of earth
 ($G = 6.7 \times 10^{-11} \text{ kg Nm}^2/\text{kg}^2$, mass of Earth = $6 \times 10^{24} \text{ kg}$ radius of Earth = 6400 kms). $2\frac{1}{2}$

2. EITHER

- (A) Describe the interior of the Sun. 5
- (B) (i) Derive the expression for mass of the sun. 3
 (ii) Calculate the mass of Jupiter if one of the satellites of planet Jupiter has time period 1.769 days and orbits in a circular orbit of radius $4.22 \times 10^8 \text{ m}$. 2

OR

- (C) What is a planet ? State the characteristics of a planet. $2\frac{1}{2}$
- (D) Write a short note on Corona. $2\frac{1}{2}$
- (E) Explain in brief :
 (i) White dwarfs and
 (ii) Black holes $2\frac{1}{2}$
- (F) Find the temperature of a star, blue in colour, having wavelength of maximum emission as 450 nm. $2\frac{1}{2}$

3. EITHER

- (A) Discuss Langevin's theory of paramagnetism and obtain an expression for paramagnetic susceptibility. 5
- (B) (i) Compare the characteristics of diamagnetic and paramagnetic substances. 3
 (ii) The transition temperature for lead is 7.26 K. The maximum critical field for the material is $8 \times 10^5 \text{ A/m}$. What is the temperature of lead in superconducting state in magnetic field of $4 \times 10^4 \text{ A/m}$? 2

OR

- (C) What do you understand by ferro magnetic domains ? Explain ferromagnetism on the basis of domain theory. 2½
- (D) State and derive Curie-Weiss law. 2½
- (E) Explain the terms critical temperature and critical magnetic field for superconductor. 2½
- (F) The susceptibility of paramagnetic FeCl_3 is 0.0037 at 27°C . What will be the value of its susceptibility at 300°K and 400°K ? 2½

4. **EITHER**

- (A) State Biot-Savart law and use it to find the intensity of magnetic field near a straight conductor carrying current. 5
- (B) (i) What is gyromagnetic ratio ? Show that the ratio of magnetic moment to the angular momentum of an electron revolving in an orbit is equal to $e/2m$, where symbols have their usual meaning. 3
- (ii) Calculate the magnetic field intensity at a distance of 5 meter from an infinite straight conductor carrying current of 100 A. 2
- [Given : $-\frac{\mu_0}{4\pi} = 10^{-7} \frac{\text{Nm}}{\text{A}^2}$]

OR

- (C) Explain the magnetic induction on the basis of the force acting on the test charge in the magnetic field. Write its SI unit. 2½
- (D) Obtain an expression for the magnetic field at the centre of an infinite solenoid. 2½
- (E) State Gauss' law of magnetisation. Derive the differential form of Gauss' law. 2½
- (F) Calculate the flux density and magnetic moment per unit volume if magnetic field of intensity $5 \times 10^5 \text{ A/m}$ is applied and magnetic susceptibility of Si is -0.4×10^{-5} . [$\mu_0 = 4\pi \times 10^{-7} \text{ SI units}$] 2½

5. Attempt any **TEN** questions :

- (i) Define gravitational constant G.
- (ii) Why acceleration due to gravity is maximum at the poles and minimum at the equator ?
- (iii) Calculate the distance of separation between two cars, if gravitational attraction of two cars is $3.2 \times 10^{-6} \text{ N}$ and masses of the cars are 1000 kg and 1200 kg.
($G = 6.67 \times 10^{-11} \text{ Nm}^2/\text{kg}^2$).
- (iv) Define solar constant
- (v) Distinguish between a planet and a star.
- (vi) What is meant by constellation ?
- (vii) What is Meissner effect ?
- (viii) Write any two applications of ferrites.
- (ix) Calculate the pole strength of the magnet having magnetic dipole moment 16 Am^2 and magnetic length 0.4m.
- (x) What is Toroid ?
- (xi) What is Lorentz force ?
- (xii) A long wire carries a current of 5mA. Find the line integral of B around the path enclosing the

wire. $\left(\frac{\mu_0}{4\pi} = 10^{-7} \text{ S.I. units} \right)$ 1×10=10