

NRT/KS/19/2048

Bachelor of Science (B.Sc.) Semester—II Examination
PHYSICS
(Gravitation, Astrophysics, Magnetism and Magneto Statics)
Optional Paper—2

Time : Three Hours]

[Maximum Marks : 50

N.B. :— (1) All questions are compulsory.

(2) Draw neat diagram wherever necessary.

EITHER

1. (A) Derive an expression for the gravitational potential due to a solid sphere at a point :
 - (i) Outside
 - (ii) On the surface of sphere. 5
- (B) (i) Define Gravitational Potential and Potential energy and obtain the relation between potential and intensity of gravitational field. 3
- (ii) Calculate the intensity of gravitational field at a distance 0.2 m from the surface of a solid sphere of mass 20 kg and radius 20 cm. Given $G = 6.67 \times 10^{-11} \text{ Nm}^2/\text{kg}^2$. 2

OR

- (C) Deduce an expression for gravitational self energy. 2½
- (D) Calculate the gravitational energy of a galaxy if the distance between a pair of stars is averagely 10^{20} m and composed of 1.6×10^{11} stars of mass 2×10^{30} each. 2½
- (E) Derive an expression for the Gauss's law. 2½
- (F) State and explain Newton's law of gravitation. Define gravitation constant (G). 2½

EITHER

2. (A) What is Star ? Deduce an expression for the mass of the sun when a planet is orbiting in a circular path of radius R. 5
- (B) (i) Write short note on Asteroids and meteors. 3
- (ii) A Star has a surface temperature of 1500°K . The Star will radiate its maximum energy in what part of spectrum ?
 [Given : Wein's constant $b = 3 \times 10^{-3} \text{ mK}$] 2

OR

- (C) What are Galaxies ? Give their classification. 2½
- (D) Write short note on corona of Sun. 2½
- (E) Explain the significance of stellar spectrum. 2½
- (F) Earth receives an amount of heat radiation $1.4 \times 10^3 \text{ Wm}^{-2}$ from the sun. Assume the earth re-emits all the radiation received from the Sun. Calculate the surface temperature of the earth. 2½

EITHER

3. (A) Explain Langevin's theory of diamagnetism and derive an expression for the magnetic susceptibility of diamagnetic substance. 5

- (B) (i) What is Curie-Weiss law ? Derive an expression for Curie temperature. 3
 (ii) The magnetic susceptibility of a medium is 940×10^{-4} . Calculate its absolute and relative permeability. 2

OR

- (C) What are Ferrites ? Write their applications. 2½
 (D) Compare ferromagnetism and ferrimagnetism. 2½
 (E) Explain the effect of temperature on antiferromagnetic material. 2½
 (F) Lead in superconducting state has critical temperature of 6.2 K, at zero magnetic field and critical field of 0.064 Am^{-1} at 0 K. Determine the critical field at 4 K. 2½

EITHER

4. (A) Deduce Ampere's circuital law. Find the expression for magnetic field due to solenoid using Ampere's circuital law. 5
 (B) (i) Obtain the expression for magnetic induction at a point due to a long straight conductor carrying current I. 3
 (ii) 20 ampere current is flowing in a long straight wire. What will be the intensity of magnetic field at a distance 10 cm from the wire $\mu_0 = 4\pi \times 10^{-7} \text{ wb/A-m}$. 2

OR

- (C) Explain the terms :—
 (i) Magnetization current
 (ii) Magnetic field vector. 2½
 (D) State Biot-Savert's Law. Obtain an expression for magnetic field intensity near a straight conductor carrying current. 2½
 (E) Deduce the relation between \vec{B} , \vec{H} and \vec{M} . 2½
 (F) A circular coil of radius 5 cm has 50 turns and carries a current of 10 mA. Calculate the magnetic induction at the centre of coil. 2½

5. Attempt any **TEN** :—

- (i) Define gravitational self energy.
 (ii) State Kepler's second law of planetary motion.
 (iii) Calculate the force of gravitation between two bodies of masses 1 kg each and distance of separation from their centre is 1 m ($G = 6.67 \times 10^{-11} \text{ Nm}^2/\text{kg}^2$).
 (iv) Write the sequence of planets in our solar system according to distance from Sun.
 (v) Define a light year.
 (vi) Give any two characteristics of star.
 (vii) Give any two examples of paramagnetic material.
 (viii) Define Curie temperature.
 (ix) Write the formula for Bohr's magneton.
 (x) Give the relation between Tesla and Gauss.
 (xi) What is magnetic susceptibility ?
 (xii) Draw magnetic lines of forces in a bar magnet. $1 \times 10 = 10$