NTK/KW/15/5796

Bachelor of Science (B.Sc.) Semester—II Examination

PHYSICS

(Gravitation, Astrophysics, Magnetism & Magneto Statics)

Compulsory Paper—II

Time—Three Hours] [Maximum Marks—50

N.B. :— (1) **ALL** questions are compulsory.

(2) Draw neat diagram wherever necessary.

EITHER

1. (A) Obtain an expression for the gravitational potential due to a thin uniform spherical shell at a point : (i) outside, (ii) at the surface and (iii) inside the shell. 5

(B) (i) Derive an expression for the gravitation potential at a point outside the solid sphere. 3

(ii) The radius of the earth is 6.637×10^6m, its mean density 5.57×10^3 kgm^{-3} and gravitational constant is 6.66×10^{-11} Nm^{2}kg^{-2}. Calculate the gravitational potential on its surface. 2

OR

(C) State any two of Kepler's laws of planetary motion. 2½

(D) Derive the relation between gravitational constant and acceleration due to gravity. 2½

(E) Derive an expression for gravitational self energy of a uniform solid sphere. 2½

(F) Find the gravitational self energy of the sun. [Given : $G = 6.67 \times 10^{-11}$ $Nm^2 kg^{-2}$, mass of sun = 2×10^{30} kg, radius of sun = 7×10^8 m.] 2½

EITHER

2. (A) Describe the interior of the Sun. Define Solar constant (S) and Solar luminosity (Ls). 5

(B) (i) Write a note on planet. State the characteristics of the planet. 3

(ii) Calculate the surface temperature of the Sun. If radius of the Sun is 6.95×10^8m and its distance from the earth is 1.496×10^{11}m.

[Given : $\sigma = 5.735 \times 10^{-8}$ $Wm^{-2}kg^{-4}$, & $S = 1.39 \times 10^3$ Wm^{-2}] 2

OR

(C) What are Galaxies ? Give their classification. 2½

(D) Explain Asteroids and Comets. 2½

(E) Describe the parallax method to measure the distance of planet from earth. 2½

(F) Find the distance of the moon from the earth if parallax angle, as measured from two places at a distance of 6.4×10^6m on earth is 57 minutes of an arc. 2½

EITHER

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

(B) (i) Calculate the magnetic susceptibility of helium gas (z = 2), if the helium atom is in ground state and the average distance of electron for it is 0.53 Å.

[Given : $n = 2.7 \times 10^{30}\ m^{-3}$, $u = 3.4 \times 10^{-7} N/A^2$, $e = 1.6 \times 10^{-19}$ C, $me = 9.1 \times 10^{-31}$ kg] 2

(ii) What is Curie-Weiss law ? Derive an expression for Curie temperature. 3

OR

(C) Explain Meissner effect. 2½

(D) Distinguish between paramagnetic materials and ferromagnetic materials. 2½

(E) What is superconductivity ? Give the significance of critical temperature. 2½

(F) The transition temperature for Pb is 7.2 K. However, at 5 K it loses the superconducting property if subjected to a magnetic field of 3.3×10^4 A/M. Find the maximum value of H, which will allow the metal to retain its superconductivity at 0 K. 2½

EITHER

4. (A) State and prove Ampere's circuital law of magnetic field and obtain Ampere's law in differential form. 5

(B) (i) Calculate the magnitude of the magnetic field due to a long thin wire carrying current of 15 Amp. at a distance of 1 cm from the wire. [Given $\mu_0 = 4\pi \times 10^{-7}$ N/A^2] 2

(ii) Define magnetic susceptibility and magnetic permeability and establish the relation between them. 3

OR

(C) State the M.K.S. and C.G.S. units of magnetic induction field ($\bar{B}$) and establish the relation between them. 2½

(D) Derive an expression for magnetic current density vector ($\bar{J}$). 2½

(E) Find the magnetic field due to a circular coil of radius 0.1 m and having 200 turns at the centre of the coil, when current circulating is 500 mA. [Given $\mu_0 = 4\pi \times 10^{-7}$ Wb/A-m] 2½

(F) Derive the differential form of Gauss law for magnetism using Biot-Savart's law. 2½

5. Attempt any **TEN** questions.

(i) State Newton's law of Gravitation.

(ii) Calculate the force of gravitation between two bodies of masses 1 kg each and distance of separation from their centre is 1 m.

[Given : $G = 6.6731 \times 10^{-11}$ Nm/kg^2]

(iii) Give any two characteristics of gravitational force.

(iv) In how many classes is stellar spectra divided ? State their letters.

(v) What is Cosmology ? State three cosmological theories of universe.

(vi) Find the diameter of the sun if the angular diameter of the sun is 0.0093 radians and sun-earth distance is 1.496×10^{11}m.

(vii) Give the classification of magnetic materials.

(viii) What is Neel temperature ?

(ix) Give any two applications of ferrites.

(x) What is gyromagnetic ratio ?

(xi) Define Solenoid and Toroid.

(xii) Calculate Bohr magneton.

[Given : $e = 1.6 \times 10^{-19}$ C, $h = 6.6 \times 10^{-24}$ J–S, $m = 9 \times 10^{-31}$ kg.] 1×10=10