NKT/KS/17/5081

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.

(2) Draw neat diagrams wherever necessary.

EITHER

1. (A) State and explain Newton's law of gravitation. Express it in vector form. What are the units and dimensions of the universal gravitation constant ? 5

(B) (i) Derive the relation between acceleration due to gravity (g) and Universal Gravitation constant (G). 3

(ii) The acceleration due to gravity on the Moon's surface is 1.67 m/s^2. If the radius of the Moon's surface is 1.74×10^6m, calculate its mass. Given : $G = 6.67 \times 10^{-11} Nm^2/kg^2$. 2

OR

(C) Derive an expression for gravitational potential due to a point mass. 2½

(D) State and explain Kepler's laws of planetary motion. 2½

(E) Derive an expression for gravitational self energy of a galaxy. 2½

(F) The Earth's mass is 80 times that of the Moon and their diameters are 12800 km and 3200 km respectively. What is the value of g on the Moon ? g on Earth is 9.8 m/s^2. 2½

EITHER

2. (A) Discuss the different types of galaxies. What type of galaxy is the Milky Way ? 5

(B) (i) Describe a method to determine the size of a planet. 3

(ii) The distance of Jupiter from the Earth is 8.247×10^8 km and its angular diameter is measured to be 35.72 seconds of an arc. Calculate the linear diameter of Jupiter. 2

OR

(C) Calculate the solar luminosity on Earth given that the distance between Sun and Earth is 1.498×10^{11} m and solar constant is 1.388×10^3 W/m^2. 2½

(D) Write short notes on comets and meteors. 2½

(E) Explain the significance of a stellar spectrum. 2½

(F) Explain a method to determine the temperature of the Sun. 2½

EITHER

3. (A) What is meant by 'superconductivity' ? State some properties of superconductors. Discuss the variation of critical field as a function of temperature. 5

(B) (i) Obtain an expression for the change in angular velocity of an electron, when a diamagnetic substance is placed in an external magnetic field. 3

(ii) Calculate the change in angular velocity of an electron when it is placed in a magnetic field of induction B = 2.5 Wb/m^2 perpendicular to the plane of the orbit.

Given : e = 1.6×10^{-19} c and m = 9.1×10^{-31} kg. 2

OR

(C) Discuss the properties of anti-ferromagnetic substances. 2½

(D) What are the important characteristics of domains ? 2½

(E) Calculate the intensity of magnetisation and susceptibility of a sample of magnetic moment $8 \times 10^3 Am^2$, cross-sectional area $16 \times 10^{-4} m^2$ and length 5 cm, when it is placed in a magnetic field of 2×10^{-7} A/m. 2½

(F) Explain graphically, the variation of magnetic susceptibility with temperature, for a paramagnetic substance. 2½

EITHER

4. (A) Define the three magnetic vectors and obtain the relation between them. 5

(B) (i) State and prove Ampere's circuital law. Express it in differential form. 3

(ii) The magnetic field strength in Copper is 10^6 A/m. If the magnetic susceptibility of copper is -0.8×10^{-5}, calculate its flux density. Given : $\mu_0 = 4\pi \times 10^{-7}$ SI units. 2

OR

(C) State the MKS and CGS units of magnetic induction and obtain the relation between them. 2½

(D) Prove that the magnetic dipole moment associated with a current carrying coil is given by M = NiA, where the letters have their usual meaning. 2½

(E) A solenoid 4m long and mean diameter 8 cm has 10^4 turns. If a current of 5 A is flowing through it, calculate the magnetic field at the centre. 2½

(F) State and explain Biot and Savart law. Express it in vector form. 2½

5. Answer any **ten** :

(i) Define gravitational field at a point.

(ii) State Gauss' theorem of gravitation.

(iii) Why is gravitational force called a central force ?

(iv) Name the planets of the solar system.

(v) What are the elements found in a star ?

(vi) A star has a surface temperature of 1500 K. In what part of the spectrum will it radiate maximum energy ? Given : Wien's constant = 3×10^{-3} mK.

(vii) Which of the following are paramagnetic–bismuth, nickel, manganese, copper, platinum ?

(viii) What is Curie temperature ?

(ix) If the relative permeability of a medium is 10^5, what is the magnetic susceptibility ?

(x) A solenoid of length 2m has 4 layers of 1000 turns each. What is the number of turns per unit length ?

(xi) State Gauss' law of magnetisation.

(xii) Define relative permeability and state its unit. 1×10=10