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PMM/KS/15/5774

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

Time—Three Hours]

[Max. Marks—50

N.B. :— All questions are compulsory.

EITHER

- (A) State Newton's Law of Gravitation and define Gravitational Constant. Obtain an expression for acceleration due to gravity at height h . 5
- (B) (i) Obtain an expression for gravitational potential due to point mass. 3
- (ii) Calculate the gravitational potential due to point mass of 200 kg at a distance of 2.5 m, if $G = 6.7 \times 10^{-11} \text{ Nm}^2/\text{kg}^2$. 2

OR

- (C) Show that the gravitational flux enclosed by the closed surface is $\phi = -4\pi GM$. $2\frac{1}{2}$

- (D) Obtain an expression for gravitational potential and intensity of gravitational field due to solid sphere at a point outside the sphere. 2
- (E) Explain the term gravitational field and gravitational self energy of a body. 2
- (F) Calculate gravitational force of attraction of two bodies which are 5 m apart, the masses of the two bodies are 500 kg and 1000 kg. 2

EITHER

2. (A) What is Galaxy ? Explain different types of Galaxies in the universe.
- (B) (i) Explain in brief structure of Sun and its solar interior.
- (ii) Calculate the luminosity of Sun, if Sun-Earth distance is 1.496×10^{11} m and solar constant $s = 1.388 \times 10^3 \text{ w/m}^2$.

OR

- (C) Explain Milky Way with respect to shape, size and cluster. 2½
- (D) What is Planet ? State the characteristics of planets. 2½



20
(E) Obtain an expression for the surface temperature of Sun. $2\frac{1}{2}$

(F) The earth receives the amount of energy from the Sun of $1.38 \times 10^3 \text{ W/m}^2$. Calculate the surface temperature of earth. If Stefan's constant of earth, $\sigma = 5.67 \times 10^{-8} \text{ W/m}^2\text{K}^{-4}$. $2\frac{1}{2}$

EITHER

3. (A) (i) What is Meissner Effect ? Show that diamagnetism is closely related to superconducting state of material. 3

(ii) The transition temperature for lead is 7.2 K, at 5 K it loses the superconducting property, if subjected to a magnetic field of $3.3 \times 10^4 \text{ A/m}$. Find maximum value of magnetic field H which will allow the metal to retain its superconductivity at 0 K. 2

(B) Explain the Langevin's theory of Diamagnetism and show that it does not depend on the temperature and intensity of external applied magnetic field. 5

OR

(C) What is Curie-Weiss Law ? Derive it. $2\frac{1}{2}$

- (D) What are Ferrites ? Explain their applications. 2½
- (E) Explain ferromagnetism on the basis of magnetic domain theory. 2½
- (F) The magnetic susceptibility of paramagnetic material is 4.9×10^{-3} at 27°C , calculate magnetic susceptibility at 200 K and 400 K. 2½

EITHER

4. (A) State and prove Amperes circuital law. Using Ampere's circuital law, find the magnetic induction B at a point inside a long current carrying solenoid. 5
- (B) (i) Define Gyromagnetic Ratio. Obtain the relation between magnetic moment and angular momentum. 3
- (ii) The charge $5 \mu\text{C}$ is uniformly distributed on the sphere of mass 2 kg. If sphere is rotating with angular velocity about its diameter, find magnetic moment of charge distribution, if angular momentum is $8.5 \text{ kgm}^2/\text{sec}$. 2

OR

- (C) Define Magnetic Dipole. Explain the meaning of magnetic moment. 2½

(D) Derive an expression for magnetic induction due to Toroid at its centre. $2\frac{1}{2}$

(E) Prove that $\mu_r = (1 + \chi_m)$ where symbols have their usual meaning. $2\frac{1}{2}$

(F) The magnetic susceptibility of a medium is 520×10^{-4} . Calculate its relative and absolute permeability. $2\frac{1}{2}$

5. Attempt any TEN questions (1 mark each) :

(i) Explain why acceleration due to gravity is maximum at the poles and minimum at the equator.

(ii) State Kepler's first law of planetary motion.

(iii) At what depth, the weight of a body becomes half the weight on the surface of Earth, if $R = 6.4 \times 10^6$ m.

(iv) What are the constituents of Universe ?

(v) Write the name of the third planet in the solar system.

(vi) Calculate acceleration due to gravity on the surface of the moon, if mass of the Moon = 7.34×10^{22} kg.
Radius of Moon = 1.738×10^6 m.

(vii) What is Neel temperature ?



- (viii) What is Ferrimagnetic substance ? Give examples of Ferrimagnetic substances.
- (ix) A magnet having magnetic length of 0.4 m, has a pole strength of 20 Am. Calculate magnetic dipole moment of this magnet.
- (x) What is Toroid ?
- (xi) Write Lorentz force equation with meaning of each symbol.
- (xii) State Biot-Savart's law.