



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

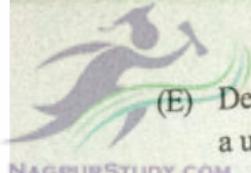
(ii) The radius of the earth is 6.637×10^6 m, its mean density 5.57×10^3 kgm $^{-3}$ and gravitational constant is 6.66×10^{-11} Nm 2 kg $^{-2}$. Calculate the gravitational potential on its surface. 2

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 : $G = 6.67 \times 10^{-11} \text{ Nm}^2 \text{ kg}^{-2}$, mass of sun = $2 \times 10^{30} \text{ kg}$, radius of sun = $7 \times 10^8 \text{ m}$.] 2½

EITHER

2. (A) Describe the interior of the Sun. Define Solar constant (S) and Solar luminosity (L_s). 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 $6.95 \times 10^8 \text{ m}$ and its distance from the earth is $1.496 \times 10^{11} \text{ m}$.
[Given : $\sigma = 5.735 \times 10^{-8} \text{ Wm}^{-2} \text{ kg}^{-4}$, & $S = 1.39 \times 10^3 \text{ Wm}^{-2}$

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 $6.4 \times 10^6 \text{ m}$ on earth is 57 minutes of an arc. 2½

(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 \AA .
 [Given : $n = 2.7 \times 10^{30} \text{ m}^{-3}$, $u = 3.4 \times 10^{-7} \text{ N/A}^2$,
 $e = 1.6 \times 10^{-19} \text{ C}$, $me = 9.1 \times 10^{-31} \text{ kg}$] 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 $3.3 \times 10^4 \text{ A/M}$. Find the maximum value of H, which will allow the metal to retain its superconductivity at 0 K. 2½

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 $\mu_0 = 4\pi \times 10^{-7} \text{ N/A}^2$] 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 (\vec{B}) and establish the relation between them. 2½

(D) Derive an expression for magnetic current density vector (\vec{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 $\mu_0 = 4\pi \times 10^{-7} \text{ Wb/A-m}$] 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 : $G = 6.6731 \times 10^{-11} \text{ Nm/kg}^2$]

(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 $1.496 \times 10^{11} \text{ m}$.

(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 : $e = 1.6 \times 10^{-19} \text{ C}$, $h = 6.6 \times 10^{-34} \text{ J-S}$,
 $m = 9 \times 10^{-31} \text{ kg}$.] $1 \times 10 = 10$