5/10/2017

VCD S.Y. B.Sc. PHYSICS-II A.T.K.T III- SEMESTER 2017-18 75 MARKS 2.30 HRS.

Note: i) All the questions are compulsory.

ii) Figures to the right indicate full marks.

iii) Use of non programmable calculator is allowed.

Q1. Attempt the following:-

A) Attempt any 1:- 8M]

a) State & explain the fundamental theorem for divergence.

b) Explain scalar triple product of three vectors with geometrical representation.

B) Attempt any 1:- 7M]

a) Explain the vector triple product of vectors **A, B and C**. show that it does not obey the commutative law.

b) If P=4i-5j+3k, Q=2i-10j-7k and R=5i+7j-4k, i) QX (PXR), ii) R. (PXQ), iii) PX(QXR).

C) Attempt any 1:- 5M]

a) Evaluate $\nabla \times (A \times r)$ for $A= a_x i+a_y j+a_z k$ and $r= xi+yj+zk$.

b) Show that the spherical polar co-ordinates of point P(3,4,5) are $[5\sqrt{2},45^{\circ},\tan^{-1}(4/3)]$.

Q2. Attempt the following:-

A) Attempt any 1:- 8M]

a) Find the work done to move a point charge in an electrostatic field. Obtain the relation between change in potential energy and potential difference between two points.

b) Show that the potential energy stored in a system of N discrete point charges is $W=1/2 \sum q_i v(r_i)$.

B) Attempt any 1:- 7M]

a) Prove that $E=-\nabla.V$ and $V= -\int E.dr$ are equivalent.

b) Obtain an expression for the potential energy of a discrete point charge distribution.

C) Attempt any 1:- 5M]

a) The electron in a hydrogen atom is most probably at a distance $r=5.3 \times 10^{-11}$m from the proton. Calculate the potential energy of the atom.[Given:- $q=1.6 \times 10^{-19}$c, $\epsilon_0= 8.85 \times 10^{-1}$ c^2/Nm^2].

b) A coil consisting of 100 closely wound turns carries a current of 1A. if the radius of the coil is 5 cm ,calculate the magnetic field at a point on its axis,at a distance 10 cm from its centre.[given:- $\mu_0 = 4\pi \times 10^{-7}$ wb/Am.]

Q3. Attempt the following:-

A) Attempt any 1:- 7M]

a) A point charge q is accelerated through a potential difference V. derive an expression for the gain in its kinetic energy.

b) Set up the equation of motion of a charged particle in a sinusoidal electric field and solve it to obtain expressions for the velocity and displacement of the particle. Represent them graphically.

B) Attempt any 1:- 8M]

a) A charged particle enters a uniform constant magnetic field. Show that it traces a helical path, in general.

b) How does Thomas parabola method establish the existence of isotopes?

C) Attempt any 1:- 5M]

a) Explain the term gyro radius. A mixed beam of proton and deuteron accelerated potential of 1000volts, enters uniform magnetic field 2 wb/m^2 in a direction at right angles to field. Calculate the separation of the proton beam from deuteron beam with each has described a semi- circle in the field. [given:- $e = 1.6X10^{-19}c$, $m_p = 1.67X10^{-27}kg$, $m_d=2m_p$].

b) If in a cyclotron adjusted to give a proton beam, the magnetic field is 1.5 wb/m^2 and the extreme radius is 0.15m, calculate the energy of emergent protons in electron volts. [given:- $e = 1.6X10^{-19}c$, $m_p = 1.67X10^{-27}kg$]

Q4. Attempt any 3: - 15M]

a) If $A= 3z^2 y-2xy^2$, $B= xz^2 -xy$. find $\nabla.(A+B)$ at point (1, 0,-1).

b) Charges -60μc, 20μc, and 30μc are placed at the corner of an equilateral triangle of side 2meter. Calculate the energy stored in the system.

c) An electron is accelerated from rest by a potential difference of 2000 volts. Calculate the velocity acquired by the electron. [given:- $e = 1.6X10^{-19}c$, $m_e = 9.1X10^{-31}kg$]

d) Prove that curl (grad Φ) =0 & div (curl F) =0.

e) Calculate the magnetic field at the centre of a circular coil of radius 4cm, carrying a current of 0.02A. The coil has 250 turns. .[given:- $\mu_0 = 4\pi \times 10^{-7}$ wb/Am.]

f) A beam of protons has been accelerated by a potential of 10^4 volt. Find the velocity of protons in the beam. [given:- $e = 1.6X10^{-19}c$, $m_p = 1.67X10^{-27}kg$]