ieeueeÙe DeeJeMe eJelejCe eoÙee peelee n :

$$\rho = \rho_0 \left(1 - \frac{r}{a}\right), \quad r \le a$$

$$= 0 \qquad , \quad r > 0$$

pene 'a' ieeue keâe e$epÙee n~

ieCevee keâeepeÙe :

(i) keâue DeeJeMe leLee

(ii) DeeJeMe eJeJejCe keâ yeenj JeÅele #e$e keâe lee›elee, r keâ ekeâme ceeve keâ eueS #e$e DeeOekeâlece n?

3. Derive an expression for the electric potential at a point due to an electric dipole, and hance deduce the electric field at that point.

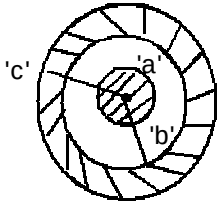
ekeâmee eyevo hej Skeâ eJeÅele-eÉOeJe eJeYeJe keâe JÙepekeâ Øeehle keâeepeÙe Deej Gmekeâ Éejle Glhe>ve JeÅele #e$e keâe ieCevee keâeepeÙe~

Unit - II 7½

FkeâeF - II

4. (a) Discuss the Ampere Circuital law with it's limitations.

(b) A coaxial line carries the same current i up the inside conductor of radius 'a' and down



A (Printed Pages 8)

Roll No. _____

S-604

B.Sc. (Part-II) Examination, 2015

PHYSICS

First Paper

(Electricity & Magnetism)

Time Allowed : Three Hours] ***[Maximum Marks : 50***

Note : Answer five questions in all. Question No. 1 is compulsory. Answer one question from each of the Units I, II, III and IV. Question No. 1 carries 20 marks. Rest of the questions are of 7½ marks each.

keâue heeÙe ØeMvee keâ Gòej oeepeS~ ØeMve me. 1 DeeveJeeÙe n~ ØelÙekeâ FkeâeF ce me Skeâ-Skeâ ØeMve keâe Gòej oeepeS~ ØeMve me. 1, 20 Dekeâe keâe n~ Me<e meYee ØeMve ØelÙekeâ 7½ Dekeâe keâe n~

1. Attempt all parts : 2×10=20

meYee Yeeie nue keâeepeÙe :

(i) What is displacement current?

eJemLeeheve Oeeje keÙee n?

(ii) A charged particle cannot be held in a stable equilibrium by electrostatic forces alone, why?

Skeâ DeeJeeMele keâCe Dekeâue FuekeŠemšeŠkeâ yeuee Éeje meleueve ce vene "njeÙee pee mekeâlee~ keÙee?

(iii) What are the limitation of Coulomb's law?

keâuecye keâ eveÙece keâe meeceeS keÙee n?

(iv) Explain the difference between magnetic induction $\vec{B}$ and magnetic field $\vec{H}$.

Ûecyekeâe Ùe øejCe $\vec{B}$ leLee Ûecyekeâe Ùe #e$e $\vec{H}$ce eYeVelee eueeKeÙe~

(v) Explain the significance of $\overline{\nabla}.\overline{B}=0$.

$\overline{\nabla}.\overline{B}=0$ keâ cenlJe keâe meceÞeeFÙe~

(vi) What is meant by induced current?

øeejle Oeeje keÙee nelee n?

(vii) Explain Skin effect.

emkeâve ØeYeeJe keâe JÙeeKÙee keâj~

(viii) What are polar and non polar molecules?

OeJeeÙe SJe DeOeJeeÙe DeCe keÙee nele n?

(ix) Diamagnetism is a universal phenomenon, explain why?

øeeleÛecyekeâlJe Skeâ meeJeYeeecekeâ leŠvee n, meceÞeeFS keÙee?

(x) Discuss the significance of Curie temperature.

keÙeje leeheceeve keâ cenlJe keâe ÛeÛee keâeeeÞeS~

Unit - I 7½

FkeâeF - I

2. (a) Derive the relation :

$\overline{E}=(-)\overline{\nabla}V$

mecyevOe øeehle keâeeeÞeÙe :

$\overline{E}=(-)\overline{\nabla}V$

(b) A spherical charge distribution is given by :

$$\rho = \rho_0\left(1-\frac{r}{a}\right),\ r \le a$$

$$= 0 \qquad ,\ r > 0$$

where 'a' is the radius of the sphere.

Calculate :

(i) The total charge and

(ii) Electric field intensity outside the charge distribution for what value of r is the field maximum?

emLej eJeÅele ce OeJeCe Meyo mecePeeFS~ DeeeCJekeâ OeJeekeâjCe keâ eueS keueeemeÙeme-ceemeeše keâe JÙepekeâ Øeehle keâeepeÙe leLee e[yeeF meMeeOeve keâe mecePeeFS~

9. (a) Explain 'Hysteresis'. Find an expression for hysteresis loss in a ferromagnetic material.

MeeLeuÙe keâe JÙeeKÙee keâeepeS~ Skeâ ueen Ûecyekeâe Ùe heoeLe keâ eueS MeeLeuÙe #eÙe keâe JÙepekeâ Øeehle keâeepeS~

(b) Define 'magnetic induction $\vec{B}$ and intensity of magnetization $\vec{M}$. Give their units. Prove that :

$$\vec{B} = \mu_0 (\vec{H} + \vec{M})$$

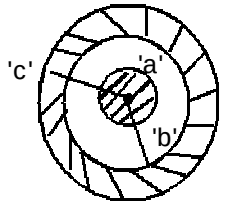
Ûecyekeâe Ùe Øejce $\vec{B}$ Deej Ûecyekeâe Ùe lee>elee $\vec{M}$ keâe heejYee<ee oeepeS~ Fvekeâ ceevekeâ yeleeFS~ emeæ keâeepeS ekeâ :

$$\vec{B} = \mu_0 (\vec{H} + \vec{M})$$

the outer conductor of inner radius 'b' and outer radius 'c'. Find the magnetic induction field at a distance 'r' from the centre of the conductor.

(De) SecheÙej mejkeÙešue eveÙece keâe Gmekeâe meeceeDee keâ meeLe eJeJeÛevee keâeepeÙe~

(ye) Skeâ mece De#eeÙe ueeFve epemekeâ Devoj keâ Ûeeuekeâ epemekeâe e$epÙee 'a' n, ce Thej keâe Dæj 'i' Oeeje ØeJeeenle nelee n leLee meceeve Oeeje 'i' veeÛe keâe Deej, yee¢e Ûeeuekeâ epemekeâe Deevleejkeâ e$epÙee 'b' leLee yee¢e e$epÙee 'c' n, Gme Ûeeuekeâ keâ keâvõ me 'r' oje hej Gmekeâ Ûecyekeâe Ùe Øejce #e$e keâe ceeve %eele keâeepeÙe~



5. What is meant by Vector potential? Derive an expression for vector potential of a straight conductor carrying a current I and hence find the expression for the associated magnetic field $\vec{B}$.

meeoMe eJeYeJe me keÙee leelheÙe n? mejue jKee meÛeeuekeâ, epemece Oeeje I ØeJeeenle ne jne n, keâ eueS meeoMe eJeYeJe keâe JÙepekeâ Øeehle keâeepeÙe leLee mecyeæ Ûecyekeâe #e$e $\vec{B}$ keâe JÙepekeâ Øeehle keâeepeS~

Unit - III 7½

FkeâeF - III

6. (a) Show that self inductance per unit volume of a solenoid having 'n' turns per unit length is $\mu_0 n^2$.

eoKeeFS ekeâ Øeele FkeâeF uecyeeF ce 'n' Heâje Jeeuee heejveeuekeâe keâe Øeele FkeâeF DeeÙeleve mJeØejkeâlJe $\mu_0 n^2$ neiee~

(b) Show that mutual inductance M between two coils of self-inductances L_1 and L_2 is :

$M = K\sqrt{L_1 L_2}$, where $K \leq 1$

On which factors does 'K' depend?

eoKeeFS ekeâ L_1 Deej L_2 mJeØejkeâlJe Jeeuee oe keâC[eueÙee keâ ceOÙe DevÙeevÙe Øejkeâlje M evecve n :

$M = K\sqrt{L_1 L_2}$, pene $K \leq 1$

'K' ekeâve keâejkeâe hej eveYej keâjlee n?

7. (a) Write down the integral as well as differential forms of Maxwell's equations in free space and explain their physical significance.

ejòeâ mLeeve ce cekemeJeue keâ JeÅele Ûecyekeâlje keâ meceekeâjCee keâe FŠe«eue leLee e[øeâeMeÙeue oevee ¤hee ce eueKe~ Gvekeâ Yeeelekeâ cenlJe keâe meceePeeFS~

(b) An electric field in free space is given by $\vec{E} = E_0 \sin(wt + \beta z)\,\hat{i}$. Using Maxwell's equations find the magnetic field $\vec{H}$.

ejòeâ mLeeve ce JeÅele #e$e $\vec{E}$, $\vec{E} = E_0 \sin(wt + \beta z)\,\hat{i}$, me eoÙee peelee n~ cekemeJeue keâ meceekeâjCee keâe ØeÙeeie keâjkeâ Ûecyekeâe Ùe #e$e $\vec{H}$ %eele keâeepeS~

Unit - IV 7½

FkeâeF - IV

8. Explain the term polarization in electrostatics. Derive Clausius-Mosotti's expression for molecular polarization and explain the Debye correction.