PHY3B03:ELECTRODYNAMICS - I

A Part

1. What are the expressions for A.B and AxBin component form?
2. How does the cross product of two vectors A and B transform under inversion?
3. What is meant by displacement vector and separation vector?
4. Prove the law of cosines
5. Find the transformation matrix R that describes a rotation by 120o clockwise when look down the axis towards the origin
6. How does the scalar triple product of three vectors A , B and C transform under inversions?
7. Show that \({\nabla(r^2) =2\bar{r}} \) where \(\bar{r}\) is the separation vector from a point \((x' ,y', z')\) to the point \((x, y, z)\) and \(r\) is its length.
8. What is the difference between irrotational field and solenoidal field?
9. What is the physical interpretation of divergence of a vector field?
10. Find the gradient of the function \(f(x,y,z) = x^2y^3 z^4\)
11. What is the physical interpretation of gradient of a scalar field?
12. Calculate the curl of the vector function \(\bar{v}_{b}=xy\hat{x}+2xy\hat{y}+3zx\hat{z}\)
13. Explain what is meant by curl of a vector field.
14. Calculate the divergence of the vector function \(\bar{v}_{b}=xy\hat{x}+2xy\hat{y}+3zx\hat{z}\)
15. Prove that the curl of a gradient is always zero.
16. Prove that the divergence of a curl is always zero.
17. State and explain the divergence theorem.
18. Explain the fundamental theorem of gradients.
19. State and explain stokes theorem.
20. Write the relation between Spherical polar coordinates and Cartesian coordinates.
21. Write down the coordinate relationship between the cylindrical and cartesian coordinates. Express the elemental displacement in cylindrical coordinate system.
22. Find the elemental area on the surface of a sphere of radius R and centre at the origin.
23. Explain the physical meaning of Dirac delta function in one dimension.
24. Write down the expression for the elemental volume and elemental area of the curved surface of a cylinder in in cylindrical coordinate system.
25. Express elemental displacement and elemental volume in spherical polar coordinates.
26. Discuss about different types of charge distributions. Give their units.
27. Define Coulomb’s law. Give an expression.

28. Graphically represent the variation of electric field with distance for a point charge.
29. Define electric field. How is it measured? Give an expression for the field due to a point charge.
30. Graphically represent the variation of electric field with distance for a conducting sphere.
31. What is permittivity? What is its value for free space?
32. Show that electrostatic field is irrotational.
33. Prove that curl of E is equal to zero.
34. Discuss about electric field lines. Give its properties.
35. Starting from the integral form of Gauss flux theorem, obtain its differential form.
36. Show that electrostatic field is conservative.
37. Graphically represent the potential inside and outside a spherical shell which carries a uniform surface charge.
38. Define potential in terms of work.
39. What is electric potential?
40. Explain Poisson's and Laplace equations.
41. Show that potential obeys superposition principle.
42. Write the boundary conditions for electric field vector E.
43. Find an expression for the work done in moving a charge in an electric field.
44. Show that the electric field inside a cavity is zero.
45. Show that when a charge is placed near a conductor, it is attracted towards the conductor.
46. Show that the electric field inside a conductor is zero.
47. Write expressions for capacitance when two or more capacitances are connected in series and in parallel.
48. Show that any charge placed inside a cavity of a conductor induces same charge on the outer surface of the conductor.
49. Show that the potential is constant throughout a conductor.
50. Show that the net charge given to a conductor resides only on the surface of the conductor.
51. What is the reason for the expansion of a soap bubble when it is charged?
52. Show that inside a conductor the charge density \[\rho =0\].
53. A person sitting inside a car with metallic body is saved from lightning. Why?
54. Show that the electric field lines just outside a conductor are perpendicular to the surface.
55. What is the reason for formation of rain drops on charged particles in clouds?
56. Explain atomic polarizability.
57. Find an expression for the torque acting on a dipole a uniform electric field.

58. Distinguish between polar and non-polar molecules with suitable examples.
59. Explain polarizability tensor.
60. What do you mean by the polarization vector P. what is its value for free space?
61. What is polarization? Define polarization vector P.
62. Write Gausses law in presence of a dielectric medium.
63. What is the difference between E and D.
64. Obtain the relation connecting E, D and P.
65. Show that the curl of D is zero.
66. What is electric susceptibility?
67. What are the three electric field vectors? Write the relation connecting them.
68. What are the effects of introducing a dielectric inside a capacitor?
69. Write the relation connecting polarizability and susceptibility.
70. Explain susceptibility tensor.
71. Write the significance of electric displacement.
72. Define the direction of a magnetic field.
73. Write down Fleming's Left hand rule
74. Find the expression for the pitch of the helical path described a charge moving with a velocity v at an angle θ w.r.t a magnetic field
75. State Fleming's left-hand rule?
76. What is the relation between current density and charge density
77. Explain current density.
78. What is cyclotron frequency?
79. Show that surface current density $K = \sigma v$; where σ is the surface charge density and v is the velocity of the charges.
80. What is Lorentz force?Write down Lorentz equation.
81. Obtain the cyclotron formula.
82. What are the dimensions and units of magnetic moment in S.I. system?
83. Write down the expression of Lorentz force law
84. Give the exprression for the force per unit length,between two long straight parallel conductors
85. A current carrying conductor does not have any net charge,then why does a magnetic field exert force on it.
86. Write the expression of the magnetic moment due to a current carrying loop

87. Write down the expressions for Biot-Savart law for i)line (ii) surface and (iii) volume current distributions.
88. Find the magnetic force experienced by a volume current distribution with current density J
89. State Biot-Savart law in vector form?
90. An electron is moving with a velocity 8i m/s in a magnetic field 3 k tesla.Find the force on the elctron and radius of curve followed by it.
91. State Ampere's circuital law and obtain the expression for the magnetic field due to a straight conductor carrying current.
92. Graphically represent the variation of the magnetic field along the axis of a current carrying circular coil.
93. What is the expression for the magnetic induction at the centre of a circular loop of radius r and carrying a current I?
94. Show that no work is done by a magnetic field,on a charged particle moving in it
95. Define Gauss's law of magnetostatics
96. What is the physical significance of del.B = 0 ?
97. Give expression for the magnetic moment of a solenoid.
98. $\varphi = \int B.ds$ and $\int_{\text{closed loop}} B.\, ds = 0$. What are physical significances of these equations?
99. Find the magnetic field inside a toroid usng Ampere's circuital law.
100. What are the integral and differential forms of Ampere’s law?
101. Write down magnetostatic boundary conditions.
102. What are the differences between the electrostatic potential and magnetic potential?
103. Explain vector potential.How is it related to magnetic flux density.
104. Give the mathematical statement of equation of continuity?
105. What is magnetic vector potential?
106. Write down the expressions for magnetic vector potential due to i)line (ii) surface and (iii) volume current distributions.
107. What is the magnitude of vector potential A?
108. Describe paramagnetism
109. What are the different basic types of magnetic materials? Give two example for each.
110. Give the important differences between various types of magnetic materials.
111. What is Curies temperature?
112. Show that force on a current loop in a non-uniform magnetic field B is F = (m.del)B
113. Show that the net force of a magnetic dipole is zero in a uniform field.
114. Define magnetisation

115. Discuss the atomic origin of diamagnetism and paramagnetism.
116. What is diamagnetism
117. Discuss the magnetic field inside matter.
118. What are bound currents?
119. What is the difference between bound current and free currents in a material?
120. Establish the relation $B = \mu 0(H + M)$
121. Obtain Amperes law in magnetised material.
122. What are the basic difference between H and B vectors?
123. Compare magnetic field B and magnetising field or auxiliary field H at a point.
124. In a laboratory dealing with currents, one generally talks about H, not B. Why?
125. Write the relation connecting M,B and H.
126. The Ampere's law uniquely determines B, if we know all the current densities. But it does not always give H uniquely. Why?
127. How hysterisis loop can be utilized for selecting materials suitable for (i)permanent magnet (ii)electromagnet
128. Explain the terms retentivity and coercivity.
129. What is the difference between linear and non linear magnetic materials?
130. Describe magnetic hysteresis curve and the various terms used in describing the curve.
131. Explain magnetic suspetibility of a material
132. What is magnetic domain?
133. What does it mean to have permeability zero?What is the corresponding value of susceptibility?

B Part

134. Prove that $Ax(BxC) + Bx(CxA)+Cx(AxB) = 0$
135. Obtain the transformation matrix for the transformation of the components of a vector when the coordinate system is rotated
136. Find the angle between the body diagonals of a cube of side 1 unit.
137. Show that $(AxB)xC \neq Ax(BxC)$
138. Show that the angle between face diagonals of a cube is 60o
139. Find the angle between the face diagonals of a cube of side 1 unit.
140. Find the separation vector from the source point (2,8,7) to the field point (4,6,8). Also construct the unit vector along that direction
141. Prove theat $Ax(BxC)=B(A.C)-C(A.B)$
142. Describe the physical meaning of divergence and curl.

143. Find the gradient of $r = \sqrt{x^2+y^2+z^2}$ (the magnitude of the position vector)
144. Discuss the gradient of a scalar field φ
145. Show that $\nabla(1/r)=\frac{-\hat{r}}{r^2}$ where $\bar{r}$ is the separation vector from a point (x', y', z') to the point (x, y, z) and r is its length.
146. State and explain the fundamental theorem of calculus.
147. State and explain the fundamental theorems of Divergence and curl
148. Check the fundamental theorem of gradients for the function $T=xy^2$ from the point (0,0,0) to the point (2,1,0)
149. Obtain an expression for the elemental area of a spherical surface of radius R in spherical polar coordinates
150. State Helmholtz theorem and deduce curlless vector field and divergenceless vector field.
151. Find an expression for the elemental volume in cylindrical coordinates.
152. What is meant by (a) divergenceless field (b) curl-less field ?
153. Obtain an expression for the elemental volume in spherical polar coordinates and hence find the volume of a sphere of radius R.
154. For a charge q at (x',y',z'), find the expression for field at (x,y,z).
155. Obtain expressions for electric field due to different types of charge distributions.
156. Find an expression for the force acting on a test charge Q due to a distribution of point charges q_i.
157. Using Gauss flux theorem, obtain the expression for field due to a point charge.
158. Find electric field inside and outside a parallel plate capacitor using Gauss flux theorem
159. Find the electric field outside, on the surface and inside a charged metallic cylinder (solid/hollow) of infinite length and radius 'a'.
160. Find the electric field at a distance 'r' from a long line charge of density λ.
161. Find the electric field due to an infinite plane sheet of uniform charge density σ using Gauss flux theorem.
162. Find the electric field outside, on the surface and inside a charged dielectric cylinder of infinite length and radius 'a'. The charge density is proportional to the distance from the axis ($\rho=kr$).
163. Using Gauss flux theorem, find the field outside, on the surface and inside a charged conducting sphere (solid/hollow) of radius 'a'.
164. Find the electric field outside, on the surface and inside a uniformly charged dielectric cylinder of infinite length and radius 'a'.
165. Use Gauss flux theorem to find the electric field outside, on the surface and inside a charged conducting sphere.
166. Find the electric field near the surface of a charged conductor using Gauss flux theorem.
167. Find the electric field outside, on the surface and inside a spherical uniform charge distribution (dielectric sphere) of charge density ρ.

168. For a point charge obtain an expression for the potential at a point and potential difference between two points.

169. Show that electric field is the negative gradient of potential.

170. If the electric potential in a region is represented by V=2x+3y-z, obtain expressions for potential gradient and electric field strength.

171. Find and then graphically represent the potential inside and outside a spherical shell of radius R which carries a uniform surface charge. Set the reference point at infinity.

172. Three point charges each of \[100\mu C\] are placed at the three corners of a square of side 10 cm. Find the total potential energy of the system, when a fourth charge of same magnitude is brought to the last corner of the square.

173. Find expressions for potentials due to different types of charge distributions.

174. Derive an expression for the energy of a point charge distribution.

175. Show that the electrostatic energy density can be represented by \[\frac{1}{2}\epsilon_0E^2\].

176. Show that the energy density of a charge distribution is \[\frac{1}{2}\rho V\].

177. Obtain expression for the work required to build up a charge distribution.

178. Find the capacitance of two concentric spherical metallic shells, with inner radius a and outer radius b.

179. What is a capacitor? Find an expression for capacitance of a parallel plate capacitor.

180. Find an expression for the mechanical pressure acting on the surface of a charged conductor.

181. Find an expression for the force acting on the surface of a charged conductor.

182. What is a cylindrical capacitor? Find an expression for its capacitance.

183. Find an expression for the force acting on a dipole in a non-uniform electric field.

184. Obtain the Boundary Conditions for the electric flux density vector D.

185. A long straight wire carrying uniform line charge λ is surrounded by rubber insulation out to a radius R. Find the electric displacement.

186. What is dielectric constant? Obtain a relation connecting susceptibility and dielectric constant.

187. A metal sphere of radius ‘a’ carries a charge Q. It is surrounded out to radius ‘b’ by a linear dielectric material of permittivity ε. Find the potential at the center relative to infinity. Also calculate the polarization and bound charge inside the dielectric.

188. Modify Gausses law for the case of a dielectric medium and obtain its integral and differential forms.

189. Find the polarization P in a dielectric material with relative permittivity 2.8, if electric flux density \[D = 0.003 nC/m^2\] Assume that the material is homogenous and isotropic.

190. Find the magnitudes of electric displacement D and polarization P for a dielectric material in which the electric field E = 0.15V/m and electric susceptibility χe = 4.25.

191. Find an expression for the force acting on a dielectric material in an electric field.

192. Obtain the following relation connecting bound charge density and free charge density in terms of electric susceptibility, \[\rho_b = \chi_e /(1 + \chi_e) \rho_f\].

193. Obtain an expression for the energy stored in a dielectric system. Also find expression for the energy density.

194. The electron in hydrogen atom circles with a speed of 2.18 x 106 m/s in an orbit of radius 0.5x1010m. What magnetic field does it produce at the centre? Also calculate the equivalent current.

195. An electron enters a magnetic field of flux density 3 T with a velocity of 2 X 107 m/s at an angle of 30 degree with the field.Calculate the magnitude of force on the electron.

196. An electron with energy 20KeV enters a uniform magnetic field of 0.02 T.Find the cyclotron frequency and radius of the circle it will describe.(me =9.1 X 10 -31 Kg, e = 1.6 X 10 -19 C)

197. An electron emitted by a heated cathode and accelerated through a potential difference of 2.0 kV enters a region with uniform magnetic field 0.15 gauss. Determine the radius of the trajectory of the electron after entering into the field, if the field is perpendicular to the velocity of the electrons.

198. An electron accelerated by 100 V enters a magnetic field of 0.05 T at an angle of 450 .Find (i) radius of the helical path of electron)ii) angular velocity (iii)pitch of the helical path.

199. Show that current density can be obtained as a product of charge density and velocity?

200. Explain cyclotron motion and cyclotron frquency?

201. A charge of 1 nC moves with v = 4i m/s along the direction of magnetic induction of 2T. Find the magnetic force on it.

202. A long straight wire carries a current 3A. An electron travels at a speed of 5x104m/s parallel to the wire 0.10 m from it and in a direction opposite to the current. Calculate the force experienced by the electron in the magnetic field of the current.

203. Suppose the magnetic field in some region has the form B = kzi (k is some constant). Find the force on a square loop of side s, lying in the y-z plane, centred at the origin which carries a current I.

204. A rectangular coil of sides 8 cm x6 cm having 2000 turns and carrying a current of 200 mA is placed in a uniform magnetic field of 0.2T directed along the positive x-axis. What is the maximum torque the coil can experience?

205. Distinguish between linear and non-linear media.Write down the expression for torques and force on magnetic dipole.

206. Two long parallel wires separated by 3 cm in air carries a current of 100 A .Find the force on 1m length of a wire.

207. A uniform B points horizontally from south to north; its magnitude is 1.5 T. If a 5.0 MeV proton moves vertically downward through this field, what force will act on it?

208. An alpha particle moves with a velocity of 0.6c parallel to a very long straight conductor carrying a current of 0.5 A at a distance of 5 cm from the conductor.Find the force experienced by the alpha particle.

209. Find the magnetic flux density B of a square wire loop of side 10cm.carrying 1 amp in clockwise direction?

210. A particle of charge 10-20 C is moving with a velocity 8x106 i m/s. It enters a region of electric field 106 j V/m and magnetic field 0.2i T. Find the force that will act on it

211. Use Biot-Savart law to find the magnetic field inside and outside an infinetely long current carrying solenoid.

212. A conductor of length 64cm is bent into a square and 4 A current is passed through it,find the magnetic field at the centre of the square.

213. A solenoid of 600 turns and carrying a current of 1 A has a length of 30 cm and radius 6 cm.Find the magnetic field at (i) the mid point (ii) a point on the axial line at 10 cm from one end.

214. Show that del.B =0

215. Show that B= del X A, where B is the magnetic flux density and A is the magnetic vector potential

216. Derive Amperes law ?

217. A solenoid has radius R,current I ,and n turns per unit length.Given that the magnetic field is B= $\mu 0$ nI inside and B= 0 outside,find the vector potential A both inside and outside.

218. A solenoid having a length of 25cm,radius 1 cm and containing 400 turns carries a current of 8 A.Calculate the magnetic induction at the centre and at its ends?Also calculate the magnetic moment of the solenoid?

219. Obtain the magnetic field due to toroid carrying a current I ?

220. A solenoid has 800 turns over a length of 0.5 m.When the current is 8A,what will be its magnetic moment and find magnetic field at the ends,Area of cross section 0.2 m square

221. Two long coaxial solenoids each carry current 2A, but in opposite directions: The inner solenoid (radius 3 cm) has 500 turns per unit length and the outer (radius 5 cm) has 1000 turns per unit length. Find B in each of the three regions: (a) inside the inner solenoid, (b) between them, and (c) outside both.

222. State Ampere's circuital law and find the magnetic field due to an infinetely long straight current carrying conductor?

223. A toroid has a core of inner radius 25cm and outer radius 26 cm around which 3500 turns of wire are wound. If the current in the wire is 11A, what is the magnetic field inside the core of the toroid?

224. With suitable example discuss any one application of Amperes law to find the field

225. A steady current I flows down a long wire of radius a. Find B, both, inside and outside the wire, if (a) The current is uniformly distributed over the outside of the wire. (b) The current is distributed in such a way that the current density is proportional the distance from the axis.

226. A solenoid has 800 turns over a length of 5 m. When the current is 8A, what will be its magnetic moment and magnetic fields at the ends? (Area = 0.02 m2 .)

227. A circular coil of radius 1 m having 100 turns carry a current of 0.2 A.Determine the magnetic field (i) along the axis at a distance 0.2 m from the centre and (ii) at the centre of the coil.

228. Write down the expressions for the magnetic induction due to a toroid and a very long solenoid at points (a) inside and (b) outside.

229. A circular coil of N turns has an effective radius ‘a’ and carries a current I. How much work is required to turn it in an external magnetic field B from a position in which θ equals zero to one in which θ equals 180o ? Given:N = 100, a = 5 cm, I = 0.10 A, and B = 1.5 T.

230. Find an expression for A for an infinitely long straight wire with current I.

231. Give a brief account of comparison of magnetostatics and electrostatics?

232. Write a note on ferromagnetism.

233. Find the vector potential of an infinite solenoid with 100 turns per unit length, radius 10 cm, and current 1 A.

234. What is magnetic vector potential?Why is it called so?

235. Compare electrostatics and magnetostatics regarding fundamental quantities,divergence and curl of respective fields?

236. What is the equation of continuity ? What is its physical interpretation?

237. Explain magnetostatic boundary condition.

238. Explain hysteresis?

239. Distinguish between para,dia and ferromagnetic materials.

240. The magnetisation vector of a material is M = xj - yi. Calculate the volume current density.

241. A cylindrical bar magnet 10 cm long and 1 cm diameter has a magnetic moment of 2 ampere -meter square.What is the magnetisation?What current to be passed through a 100 turn solenoid of the same dimension to give it the same magneyic moment?

242. Calculate the change in magnetic moment of a circulating electron of the electron in hydrogen atom, if a magnetic induction of 2.0 T acts at right angles to the plane of the orbit.

243. Find the intensity of magnetisation inside a metal rod if a magnetising field results in a magnetic field 2 X 10-4 weber-m -2 induced in vacuum and a magnetic field 1.2 X 10 -3 weber- m -2 induced inside the material of rod.

244. Find the magnetic moment of iron rod 40 cm long and 12 mm in diameter has relative permeability 1000.If it is placed inside a long solenoid wound with 400 turns/metre which allows a current of 1 ampere to flow through it,find the magnetic moment of the rod.

245. A short circular cylinder of radius R and length L carries a uniform magnetisation M parallel to axis.Find the bound current.

246. Derive the expression showing the effect of magnetic field on atomic orbit?

247. Show that the vector potential A, hence B, due to a magnetised material can be expressed as the sum of contributions from a surface bound current and volume bound current.

248. Derive JM = del×M.

249. An infinitely long circular cylinder carries a uniform magnetisation M parallel to its axis.Find the magnetic field inside and outside the cylinder.

250. An infinite solenoid with n number of turns per unit length is filled with a material with susceptibility χm. Find H, B and M of this solenoid. Obtain Kb from M in this case.

251. An iron torus of inner diameter 10 cm,outer diamter 12 cm,has 20 turns of wire wound on it.Given B-field of 1.2 tesla requires on H-field of about 120A/m.Estimate the current required to produce a field of 1.2 tesla in the iron

252. A long copper rod of radius 1 cm carries a uniformly distributed free current 1 ampere.Find H at a point 0.6 cm (inside) and 2 cm (outside) from the axis of cylinder.

253. A magnetic material in the form of a rod of length 1m,has a coil of 400 turns wound over it uniformly.If a current of 1 ampere is passed through it,calculate (a) magnetising field H (b) Magnetisation M (c)

Magnetic field B inside the rod and (d) relative permeability μr of the matrial of rod.Given χm = 6 X 10 -3

254. A cylindrical copper rod of radius R carries a uniformly distributed current I.Find H and B of this rod at various points.

255. Derive Amperes law in magnetized materials?

256. How does one modify Ampere's law while considering magnetised materials?

257. Magnetic induction vector enters from a medium 1 with permeability μ1 to another medium with permeability μ2. Find a relation between B1 in medium 1 and B2 in medium 2.

258. A toroidal winding of N turns surrounding a ferromagnetic specimen in which a narrow gap of width d has been cut.Calculate the value of magnetic field both in the gap and in the material.

259. Explain hysteresis?

260. Obtain the relation between magnetic susceptibility and permeability of a medium.

261. An ideal solenoid having 40 turns/cm has an aluminium core and carries a current of 2 A. Calculate the magnetisation developed in the core and the magnetic field at the centre. The susceptibility χ of aluminium = 2.3×10-5

262. Write a note on ferromagnetism.

C Part

263. Define gradient of a scalar function (b) divergence and (c) curl of a vector function. Explain their physicsl interpretation.

264. State and explain the fundamental theorems of calculus, gradients, divergence and curl.

265. State and prove Gauss flux theorem. Using Gauss flux theorem, find the field outside, on the surface and inside a charged conducting sphere.

266. Show that electric field is the negative gradient of electric potential and obtain Poisson's and Laplace's equation.

267. With the help of suitable diagrams, derive the boundary conditions for electric field vector E. Also obtain the boundary conditions for electric potential.

268. Obtain an expression for the electric potential and field due to polarized object. Also obtain expressions for the volume bound charge and surface bound charge in terms of P.

269. A slab of linear dielectric material is partially inserted between the plates of a charged parallel plate capacitor. Derive an expression for force acting on the slab.

270. Derive Clausius-Mossotti relation connecting polarizability and susceptibility.

271. A steady current I flows down a long wire of radius a. Find B, both, inside and outside the wire, if (a) The current is uniformly distributed over the outside of the wire. (b) The current is distributed in such a way that the current density is proportional the distance from the axis.

272. Discuss the motion of electric charges in transverse electric and magnetic fields '

273. A charged particle is released from a point in a region where there are a magnetic field and an electric field at right angles.Show that it will move along a cycloid.

274. a)State and explain Biot-Savart law (b) Derive an expression for the magnetic field due to a circular loop of current at a point on axis of the coil.

275. a)State Biot-Savart law (b) Derive an expression for the magnetic field due to an current carrying conductor at a point near to it

276. Derive the equations for the divergence and curl of magnetic field B.

277. State Amperes circuital law and apply it to find the flux density inside a solenoid and toroid?

278. Derive an expression for the magnetic field intensity on the axis of a circular coil carrying current.Plot the field against distance.

279. Derive the expression for the magnetic field along the axis of a tightly wound solenoid consisting N turns per unit length and wrapped around a cylindrical tube of radius R and the turns carrying current I.

280. What are magnetic boundary conditions? Derive them in vector form.

281. a) Derive the expression showing the effect of magnetic field on atomic orbit. (b) Derive the relation connecting magnetic suspetibility and permeability.

282. Discuss the effect of magnetic field on atomic orbits.

283. Show that the vector potential A, hence B, due to a magnetised material can be expressed as the sum of contributions from a surface bound current and volume bound current. Describe physical interpretation of bound currents.

284. Find bound currents inside a magnetized object

285. Discuss in detail the Ampere's law in magnetized materials.Derive an expression for the magnetic field at any point inside and outside of a long copper rod of radius R carries a uniformly distributed current I

286. Briefly explain the domain theory regarding ferromagnetism and explain charachteristic behaviour of ferromagnetic material with the help of hysterisis lo