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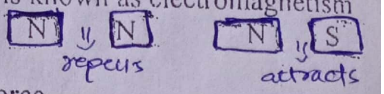
Chapter #14
Electromagnetism

1. The material which attract small pieces of iron called magnet
2. The branch of physics deals with properties of magnetic field associated with the motion of charges(current) or current induced in the conductor when placed in variable magnetic field This branch is known as electromagnetism
3. Like poles of two magnets repel each other while un-like poles attract each other as 

4. A magnet is heated, it looses its magnetic properties and known as de- magnet
5. Due to the motion of charges in the conductor, a force produced called as magnetic force
6. The charges are moving (projected) with the velocity (V) in the conductor, placed at the angle (Θ) in the magnetized sheet. The magnetic force F=qBVSINΘ. This force maximum when the conductor is placed perpendicular in the magnetized filed (where B is magnetic Induction).
7. Orested scientist(1819) proved that the magnetic field exists around a wire carrying the current
8. The field around the moving charge particle is called magnetic field
9. The magnetic lines of force form circle and these lines do not inter act to each other
10. The magnetic field stronger near the conductor ,it becomes weaker away from the conductor
11. The direction of magnetic field is determined by Right Hand Rule
12. The strength of magnetic field is called magnetic induction (B). it is a vector quantity
13. When a charge particle is projected (fired) in magnetic field at the angle(Θ) ,a force produced known magnetic force F∝B F∝V F=qBVSINΘ
14. The magnetic force becomes zero when both B and V are parallel Sin90° = 0
15. The magnetic force maximum when B and V perpendicular to each other b/c SIN90=1
16. Magnetic induction may defined as one ampere current passes through the unit length conductor is placed in magnetic field experiences 1N force ,the magnetic induction said to be one Tesla (Tesla = weber/m²).
17. The current carrying conductor (Rectangular coil) placed in magnetic field, the torque τ=BAINCOSΘ. This torque maximum when the coil parallel to the magnetic field b/c COS0=1
18. The magnetic flux over a surface is defined as the number of lines of magnetic induction crossing the magnetic surface normally
19. The flux passing through a unit area normally ,known as magnetic flux density (B) it is a scalar quantity
20. Each line of magnetic induction known as one Weber B=wb/A
21. If the magnetic induction (B) is 5 Tesla, the magnetic flux density is 5 wb/m²
22. The centripetal force by the object is moving in circular form is F=mv²/r
23. The radius of circular path in magnetic field is r =mv/qB
24. The symbols(.) and (x) indicate that magnetic field in to the paper and out of paper respectively
25. The velocity of electron can determined by two apparatus (1)CRT (2) Particle velocity selector(PVS)
26. The velocity of electron by CRT: v =$\sqrt{2V/m}$ where V is high voltage used in the filament emitted the beam of electron
27. The velocity of electron by particle velocity selector (PVS): v =E/B
28. The charge to mass ratio e/m=2V/B²r² the mass of electron is 9.11x10 Kg
29. The charge to mass ratio of electron is 1.7x10 C/Kg and for neutron is zero
30. The purpose of Ampere law to determine the magnetic flux density(B) at any point around the current carrying conductor
31. Ampere law states that the magnitude of flux density at any point around the long straight conductor is directly proportional to the current and inversely proportional to the distance (Radius) B∝I, B∝1/r B∝I/r B=μ_oI/2πr where μ_o is called permeability of free space and its value is 4πx10 wb/mA
32. Ampere law may also defined as the sum of the products of the tangential components of magnetic induction and elementary length (∇l)of a closed curve is μ_o times current enclosed through the curve. B∇l=μ_oI
33. According to Ampere law magnetic flux density independent from any size or shape
34. The solenoid is a copper wounded cylinder carrying the current produced the induction B=μ_o nI where n is the number of turns in unit length
35. The magnetic induction out of solenoid is negligible becomes zero b/c the length of coil (l) and magnetic field(B) are normal to each other(COS90=0)
36. In the solenoid, the magnetic lines nearly parallel
37. Toriod is a circular solenoid produced the magnetic induction B=μNI/2πr where N is the total number of turns of toriod and 2πr is the circumference of circle
38. Joseph Henry (1830) and Faraday (1831) proved that an emf (Electro magnet force) is set up in a coil placed in a magnetic field when the flux through the coil changes. This induced emf is called Electro magnetic force
39. If the loop forms a closed circuit due to the emf, the current flows through the coil. This current is called as the induced current

40. When a magnet moves to wards a coil or vice versa, the flux passing through the coil changes and emf produced called as dynamically induced emf
41. When a current passing through the coil changes, the flux passing through the coil (Neighboring) changes due to which induced emf proceed in the neighboring coil
42. Faraday first law of Electro magnetic induction states that when flux passing through the coil is changed, an emf is induced in the coil the emf laste so long as the change of flux is in progress
43. The emf becomes zero ,when the flux constant
44. When the conductor or coil in magnetic field is at rest, the emf does not produced b/c flux remains constant
45. Faraday second law of Electro magnetic states that the magnitude of induced emf depends only on the number of turns and the rate of change of flux through the coil $E=-N\nabla\Phi/\nabla t$ where $\nabla\Phi$ is the change of flux and –ve sign indicates that emf opposes the cause by which it produced
46. Flux linkage is defined the product of number of turns and the flux through the coil Flux linkage=$N\Phi$
47. In 1835 scientists Lenz proved the direction of induced current composed a law called Lenz law. This law states that the induced current always flows in such direction as to opposes the changes, which rises to it
48. Self induced emf is directly proportional to the rate of change of current ie $E\propto \nabla O/\nabla t$ $E=-L\nabla I/\nabla t$ where L is constant is known as self inductance of the coil ,its unit is Henry and the –ve sign shows that emf opposes the cause
49. One Henry defined as if the current changes at the rate of 1A in the coil the emf produced one volt the inductance is said to be one Henry
50. Mutual induction is defined as the emf in the secondary coil is directly proportional to the rate of change of current in the primary coil ie $E\propto \nabla I/\nabla t$ $E=M\nabla I/\nabla t$ where M is called mutual inductance of the coil, and its unit is Henry
51. One Henry is also defined as if the current changes at the rate of 1A/sec in the primary coil produces an emf of one volt in the secondary coil when the mutual inductance of the pair coil said to be one Henry
52. When a conductor is moved across a magnetic field, a potential difference appears across it. This pd known motional emf it is equal to $E=-BVL$ where –ve sign indicates that E opposes the cause
53. The pd b/w the ends of conductor of length(L) moving with the velocity(V) perpendicular($SIN90^{\circ}=1$)to the magnetic field of magnetic induction(B)is called motional emf
54. Alternating current(AC) generator also known as dynamo, is a device which converts mechanical energy to electrical energy
55. The principle on which generator works as when flux changes an emf is produced as according to the faraday law
56. The main parts of generator(1)magnetic field (2)Armature(3) slip ring and collecting brushes
57. DC generator produces uni-directional current
58. DC generator produces the current which does not change its polarity
59. The device which converts electrical energy in to mechanical energy is known as electric motor
60. The principle on which motor works as when a current flows through a coil or conductor placed in a uniform magnetic field a torque is produced due to which it rotates
61. The transformer is a static machine which used to change the AC voltage from higher level to lower level or vice versa
62. The transformer changes the AC voltage from one circuit to the other circuit under the same frequency and same power
63. The transformer consist two coil(windings) one primary coil and other secondary coil
64. If the T/F changes the voltage higher level to lower level that T/F is known step down transformer
65. If the T/F changes the voltage lower level to higher level that T/F is known step up transformer
66. If the number of primary coil less than the secondary coil ie $N_1 < N_2$ this T/F is known step up T/F
67. If the number of primary coil greater than the secondary coil ie $N_1 > N_2$ this T/F is known step down T/F
68. The transformer ratio $V_2/V_1 = N_2/N_1 = I_1/I_2$
69. The transformer rated in KVA
70. The T/F losses are (1) Copper losses (2) Iron losses
71. The core of T/F formed in the lamination form produced the eddy current due to the iron losses
72. The iron losses of the T/F is always constant but copper losses changed due to the load
73. The losses of the T/F measured in WATT(kW) the copper losses formula I^2R
74. The T/F coils (windings) electrically isolate but magnetically inter connected to each other
75. The coil connected to the main supply is known primary coil and the coil connected to the load is known secondary coils