CHAPTER 15

ELECTROMAGNETISM

CONCEPT MAP

ELECTROMAGNETISM

Is the study of magnetic forces produced by Electric currents

- In straight wires immersed in an external magnetic field → Where current direction can be predicted by Fleming's left-hand rule
- In two parallel current carrying wires → Which
  - attract for like currents
  - repel for unlike currents
- In rectangular coil immersed in an external magnetic field → Whose turning effect is applied in the d.c. motor

ELECTROMAGNETIC INDUCTION

Can be summarized by

Faraday's Law

Magnitude of e.m.f generated α Rate of change of magnetic lines of force linking the circuit

Diodes: Half-wave or full-wave rectification

a.c. generator

Voltage Output

Observed by

Cathode Ray Oscilloscope (C.R.O.)
- X-and Y-shift
- time-base
- Y gain

Lenz's Law

Direction of induced e.m.f/current opposes change in magnetic lines of force producing it

applied in

a.c. generator

Transformer
- Turns ratio: $\frac{N_s}{N_p} = \frac{V_s}{V_p}$
- Conservation of Energy: $I_s V_s = I_p V_p$

used in

Transmission of power p at high voltage V and low current/ P = IV

MULTIPLE CHOICE QUESTIONS

15.1 and 15.2 Magnetic Effects of a Steady Current and Force on a Current – Carrying Conductor Placed in Magnetic Field

1. _____ is a study of magnetic effects of current
   (a) Electrostatics (b) Electricity (c) Electromagnetism (d) Electronics
2. Who discovered that when current passes through a conductor it produces a magnetic field around it
   (a) Lenz (b) Coulomb (c) Ampere (d) Faraday
3. When current passes through straight conductor it produce magnetic field in the form of
   (a) Straight line (b) Concentric circles (c) Rectangular form (d) Parabolic shape
4. The magnetic field produced in straight current carrying conductor is stronger
   (a) Near pole (b) Near current carrying conductor
   (c) Away from current carrying conductor (d) None of these
5. The magnetic field produced in straight current carrying conductor is weaker
   (a) Near pole (b) Near current carrying conductor
   (c) Away from current carrying conductor (d) None of these
6. Weak ionic current that travel along the nerve can produce the _____
   (a) Electric effect (b) Magnetic effect
   (c) Electric and Magnetic field (d) All of these
7. MRI stands for
   (a) Magnetic resonance imagining (b) Magnetic resistance and current
   (c) Magnetic resistance imaginary (d) None of these
8. The magnetic lines of Force can be traced on cardboard by using:
   (a) Cardboard (b) Compass Needle (c) Paper (d) Magnet
9. Shape of Magnetic lines of force in straight Conductor are:
   (a) Straight (b) Elliptical (c) Circular (d) All of them
10. Direction of Magnetic lines of force in straight conductor is found by:
    (a) Right hand rule (b) Left hand rule (c) Both a & b (d) None of them
11. If the current is flowing from bottom end to top then the direction of magnetic lines of force will be:
    (a) Anti-Clockwise (b) Clockwise (c) Straight (d) None of them
12. If the current is flowing from top to bottom then the direction of magnetic lines of force will be:
    (a) Anti-Clockwise (b) Clockwise (c) Straight (d) None of them
13. A dot(•) on paper indicates that the current is directed:
    (a) Out of Plane (b) Towards us (c) Into the Plane (d) Bath a & b
14. A Cross(x) on paper indicates that the current is directed:
    (a) Out of plane (b) Away from us (c) Into the Plane (d) Both b & c

15. **Magnetic field in most part of the coil is:**
(a) Circular (b) Straight (c) Uniform (d) Non-Uniform

16. **A closely wound cylindrical coil of insulated wire is:**
(a) Cylindrical coil (b) Solenoid (c) Cable (d) All of them

17. **Magnetic lines of force in solenoid are:**
(a) Circular (b) Parallel (c) Non-Uniform (d) Uniform

18. **Lines of force in solenoid resemble the pattern of lines of force due to:**
(a) Electromagnet (b) Horse shoe magnet (c)Bar magnet (d) All of them

19. **The polarity of current carrying solenoid is found by:**
(a) Right Hand Rule (b) Left Hand Rule (c) Both a & b (d) None of them

20. **Hold down the end of the current carrying solenoid in front of you, if the direction of current flow through this end is anti-clock wise it would be:**
(a) North Pole (b) South Pole (c) any of them (d) None of them

21. **Hold down the end of the current carrying solenoid in front of you, if the direction of current flow through this end is clockwise it would be:**
(a) North Pole (b) South Pole (c) Any of them (d) None of them

15.3 and 15.4 Turning effect on current carrying coil in magnetic field and D.C motor

22. **Force on current carrying conductor in a magnetic field is found by:**
(a) Right Hand Rule (b) Left Hand Rule (c) Both a & b (d) None of them

23. **A device which is used to convert electrical energy into mechanical energy:**
(a)Transformer (b) A.C Generator (c) D.C Motor (d) All of them

15.5, 15.6 and 15.7 Electromagnetic Induction, Direction of induced e.m.f – Lenz's Law and A.C generator

24. **Electromagnetic induction was discovered by:**
(a) Newton (b) Galileo (c) Einstein (d) Faraday

25. **Who found the direction of induced e.m.f first time?**
(a) Faraday (b) Lenz (c) Henry (d) Bohr

26. **The value of induced emf is directly proportional to the rate of change of:**
(a) Current (b) Resistance (c) Potential (d) Flux

27. **The number of magnetic lines of force passing through any surface:**
(a) emf (b) Current (c) Flux (d) Resistance

28. **The magnitude of induced emf depends upon the speed of:**
(a)Magnet (b) Coil (c) Current (d) relative Motion

29. **A device used to convert mechanical energy into electrical energy:**
(a) Transformer (b) A.C Generator (c) D.C Motor (d) All of them

30. **A generator works on the principle of:**
(a) Electromagnetic induction (b) Electrostatic induction
(c)Both of them (d) None of these

15.8 and 15.9 Mutual induction and Transformer

31. If the Current is induced in a circuit due to change of current in an other circuit, this process is known as:
(a) electrostatic induction (b) mutual induction
(c) self induction (d) none of them

32. The coil of transformer in which change in current produces induced current in another coil is known as:
(a) Primary (b) Secondary (c) Solenoid (d) All of them

33. A coil in which current is induced is known as:
(a) Primary (b) Secondary (c) Solenoid (d) All of them

34. If the current through a coil or a circuit changes and this change induces an emf in the circuit itself, this process is known as:
(a) electrostatic induction (b) mutual induction (c) self induction (d) none of them

35. An electrical device which is used to increase or decrease the value of alternating voltage:
(a) Transformer (b) A.C Generator (c) D.C Motor (d) All of them

36. The coil which is connected to the alternating voltage whose value is to be altered is known as:
(a) Primary Coil (b) Secondary Coil (c) Solenoid (d) All of them

37. The Coil of transformer in which alternating voltage is induced is known as:
(a) Primary Coil (b) Secondary Coil (c) Solenoid (d) All of them

38. Transformer works on the principle of:
(a) Electrostatic induction (b) Mutual Induction
(c) Self Induction (d) All of them

39. Type of transformer which is used to increase the value of alternating voltage:
(a) step up (b) step down (c) step forward (d) step back

40. Type of transformer which is used to decrease the value of alternating voltage:
(a) step up (b) step down (c) step forward (d) step back

41. When a straight current carrying conductor is placed in a magnetic field at right angle to it, the direction of force acting on conductor is:
(a) Same as the direction of field (b) Opposite to the direction of the field
(c) Makes an angle of 45^0 with the current (d) At right angle to both the field and current

42. A transformer has 100 turns in primary and 500 turns in the secondary. If 6 Volts D.C is applied across its primary, the voltage induced across its secondary would be:
(a) 0V (b) 30V (c) 45V (d) 60V

43. Walk through metal detector are installed at airport and other places for
(a) Security purpose (b) Decoration (c) Useless purpose (d) All of these

44. **A practical application of mutual induction is:**

(a) Transformer (b) Electrical motor (c) Generator (d) Diode

45. **Number of truns on the primary coil is represented as:**

(a) N_s (b) N_p (c) N_s (d) N_u

46. **Number of turns on secondary coil is**

(a) N_s (b) N_d (c) N_u (d) N_p

47. **In step-up transformer:**

(a) $V_s > N_s$ (b) $U_p > V_p$ (c) $V_s > V_p$ (d) $V_s > N_s$

48. **Transformer is called step-down when:**

(a) $V_s > V_p$ (b) $V_s > N_s$ (c) $V_p < V_s$ (d) $V_s < V_p$

49. **Electric power is usually generated at places which are far from the places where it is:**

(a) Consumed (b) Produced (c) Not needed (d) Developed

50. **Voltage of current supplied to consumers is:**

(a) 230 V (b) 240 V (c) 210 V (d) 220 V

51. **Electromagnet is used in device**

(a) Electric bell (b) Relay (c) Both A and B (d) Thermometer

52. **Which is an electric switch that opens and closes under the conrol of another electrical circuit**

(a) Relay (b) electric bell (c) electric circuit (d) A.C Generator

ANSWER KEY

Q.	Ans	Q.	Ans	Q.	Ans	Q.	Ans	Q.	Ans	Q.	Ans
1	c	11	a	21	b	31	b	41	d	51	c
2	c	12	b	22	b	32	a	42	a	52	a
3	b	13	a	23	c	33	b	43	a		
4	b	14	c	24	d	34	c	44	a		
5	c	15	a	25	b	35	a	45	b		
6	b	16	b	26	d	36	a	46	a		
7	a	17	b	27	c	37	b	47	c		
8	b	18	c	28	d	38	b	48	d		
9	c	19	a	29	c	39	a	49	a		
10	a	20	a	30	a	40	b	50	d		