**General Instructions:**
(i) All parts are compulsory.
(ii) For Part – A questions first written – answer will be considered for awarding marks.
(iii) Answers without relevant diagram/figure/circuit wherever necessary will not carry any marks.
(iv) Direct answers to Numerical problems without detailed solutions will not carry any marks.

## PART – A

**I   Pick the correct option among the four given options for ALL of the following questions**

                                                                                                    **15 x 1 = 15**

1) The SI unit of electric dipole moment is
   (A) Cm                    (B) $Cm^{-1}$                    (C) tesla                    (D) volt

2) The device which is used to store electrical charges and electrical energy is called
   (A) capacitor             (B) resistor                    (C) inductor                 (D) transformer

3) The shape of equipotential surface around a positive point charge is
   (A) cylindrical           (B) rectangular                 (C) spherical                (D) helical

4) The resistance of a wire is R. If length of the wire is doubled and area of cross section is halved, the new resistance of the wire is
   (A) R/2                   (B) 2R                          (C) 4R                       (D) 16 R

5) The nature of the force between two straight parallel conductors carrying current in same direction placed in air/vacuum is
   (A) repulsive                                    (B) either attractive or repulsive
   (C) attractive                                   (D) gravitational

6) Galvanometer can be converted into an ammeter by connecting a
   (A) low resistance in series with it            (B) low resistance in parallel with it
   (C) high resistance in parallel with it         (D) high resistance in series with it

7) The material which is weakly repelled by a bar magnet is called a/an
   (A) ferromagnetic material                      (B) paramagnetic material
   (C) electromagnet                               (D) diamagnetic material

8) Lenz's law is in accordance with
   (A) law of conservation of linear momentum      (B)  law of conservation of energy
   (C) law of conservation of angular momentum     (D) law of conservation of mass

9) The power factor for an AC circuit is maximum for
   (A) resistor             (B) inductor                     (C) capacitor                (D) diode

10) The scientist who predicted the existence of the electromagnetic waves is
    (A) Heinrich Hertz                               (B) James Clerk Maxwell
    (C) Albert Einstein                              (D) Issac Newton

11) Snell's law is not valid for
    (A) normal incidence                             (B) angle of incidence equal to $90^0$
    (C) angle of incidence is equal to $45^0$        (D) angle of incidence equal to $60^0$

12) The shape of wave front emerging from a linear source at a small distance is
    (A) spherical        (B) cylindrical       (C) planar    (D) elliptical

13) The minimum frequency of incident radiation below which photoelectric effect does not take place is called
    (A) stopping potential           (B) work function
    (C) threshold frequency          (D) threshold wavelength

14) Radius of a nucleus varies with its mass number A as
    (A) directly proportional to $A^{1/3}$        (B) inversely proportional to $A^{1/3}$
    (C) directly proportional to $A^{1/2}$        (D) inversely proportional to $A^{1/2}$

15) For an insulator, the energy gap is
    (A) $\geq 0.3$ eV       (B) $< 0.3$ eV      (C) $> 3$ eV      (D) $< 3$eV

**II  Fill in the blanks by choosing appropriate answers given in the brackets for ALL the following**
   **question.**                           **5 x 1 = 5**

   **(pentavalent, electric polarisation, isotopes, excitation potential, longitudinal, trivalent)**

16) Net electric dipole moment per unit volume of the substance is called------------

17) According to Christian Huygens's, light is -------------------- wave

18) The minimum accelerating potential required for an electron to jump from the lower energy state to higher energy state is called----------------

19) Nuclei with same atomic number but different mass numbers are called------------

20) N- type semiconductor is obtained by adding ------------------- impurities is germanium.

## PART- B

**III  Answer any FIVE of the following questions**              **5 x 2 = 10**

21) State and explain Gauss's law in electrostatics.

22) A current of 2A flows through a long straight conductor. Calculate magnetic field at a distance of 0.2 m.

23) Write the expression for magnetic field at a point inside the current carrying solenoid and explain the terms.

24) What is self inductance of a coil? Write its SI unit of self inductance of a coil.

25) Write any two sources of power losses in a transformer.

26) Write any two uses of ultra violet radiations.

27) Define power of a lens. Write the SI unit.

28) Write any two properties of a photon.

29) Distinguish between conductors and insulators based on band theory of solids

## PART C

**IV    Answer any FIVE of the following questions**           **5 x 3 = 15**

30) Write any three properties of electric field lines.

31) Derive an expression for potential energy of a system of two charges in the absence of an electric field.

32) Derive an expression for electric current through a metallic conductor in terms of drift velocity.

33) State Biot-Savart's law.

34) Distinguish between diamagnetic and ferromagnetic materials.

35) Write any three uses of optical fibres.

36) Write any three laws of photoelectric effect.

37) Write Bohr's postulates for hydrogen atom.

38) Find the binding energy in MeV of nitrogen nucleus ($_7N^{14}$). Given mass of nitrogen nucleus = 14.00307 u, mass of the proton = 1.00782 u and mass of neutron = 1.00867 u.

## PART D

**V      Answer any THREE of the following questions                    3 x 5 = 15**

39) Derive an expression for electric field due to an electric dipole at a point on the equatorial line.

40) Derive an expression for the effective emf and effective internal resistance of two cells connected in parallel.

41) Derive an expression for magnetic field at a point on the axis of a current carrying circular coil.

42) What is an AC generator? Describe the principle and working of an AC generator.

43)     a) Write the conditions for total internal reflection                              (2)

        b) Derive an expression for equivalent focal length of two thin lenses in contact.     (3)

44)     a) What is rectification?                                                        (1)

        b) Explain the working of a full wave rectifier using the circuit diagram.

          Also draw input – output waveforms.                                           (4)

**VI    Answer any TWO of the following questions                        2 x 5 = 10**

45) Two charges 3 x $10^{-8}$ C and -2 x $10^{-8}$ C are located 15 cm apart. At what point on the line joining the two charges is the electric potential zero? Take the potential at infinity to be zero.

46) Four resistances of 12Ω, 15Ω, 10Ω and 4Ω respectively are connected in cyclic order to form a Wheatstone's network. Is the network balanced? If not, calculate the resistance to be connected in parallel with the resistance of 10Ω to balance the network.

47) A 20 Ω resistor, 1.5 H inductor and 35 µF capacitor are connected in series with AC source 220V-50Hz supply. Calculate the impedance of the circuit and also find the current through the circuit.

48) In Young's double slit experiment wavelength of light used is 5000 Å, distance between the slits is 2 mm and distance of the screen from the slits is 1 m. Calculate the fringe width and also calculate the distance of the 7th dark fringe from the central bright fringe.

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