**(English Version)**

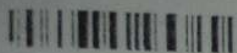
- Instructions :**
1. All Parts are compulsory.
 2. Answer without relevant diagram/figure/circuit wherever necessary will not carry any marks.
 3. Numerical problems solved without writing the relevant formulae carry no marks.

PART – A

I. Answer **all** the following questions :

(10 × 1 = 10)

- 1) Write the SI unit of electric flux. ✓
- 2) Graphically represent the variation of resistivity of a semiconductor with absolute temperature. ✓
- 3) Give any one use of electromagnet. ✓
- 4) What is the significance of Lenz's law? ✓
- 5) How does capacitive reactance vary with frequency? ✓
- 6) Arrange the following electromagnetic waves in ascending order of their wavelength :
Radio waves, Gamma rays, Infrared waves, X-rays. ✓
- 7) Why does sky appear blue? ✓
- 8) Mention a method to increase the resolving power of a microscope. ✓
- 9) Write the nuclear reaction equation for alpha decay of ${}_{92}^{238}\text{U}$. ✓
- 10) Draw the logic symbol of NOR gate. ✓



PART - B

II. Answer **any five** of the following questions :

(5 × 2 = 10)

11) State and explain Coulomb's law in electrostatics.

12) A parallel plate capacitor with air between the plates has a capacitance C . What will be the capacitance if

a) the distance between the plates is doubled?

b) the space between the plates is filled with a substance of dielectric constant 5?

13) Write two limitations of Ohm's law.

14) In a region, an electric field $\vec{E} = 5 \times 10^3 \hat{j} \text{ NC}^{-1}$ and a magnetic field of $\vec{B} = 0.1 \hat{k} \text{ T}$ are applied. A beam of charged particles are projected along X-direction.

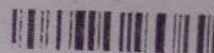
Find the velocity of charged particles which move undeflected in this crossed fields.

15) Define "retentivity" and "coercivity".

16) Mention two sources of energy loss in transformer.

17) What is displacement current? Give the expression for it.

18) An alpha particle, a proton and an electron are moving with equal kinetic energy. Which one of these particles has the longest de Broglie wavelength? Give reason.



PART – C

III. Answer **any five** of the following questions :

(5 × 3 = 15)

- 19) Establish the relation between electric field and electric potential. ✓
- 20) Derive the expression for the energy stored in a charged capacitor. ✓
- 21) Give the principle of cyclotron and draw the neat labelled schematic diagram of cyclotron. ✓
- 22) Mention three properties of diamagnetic materials. ✓
- 23) Arrive at the relation between focal length and radius of curvature of a spherical concave mirror. ✓
- 24) Using Huygen's principle, show that the angle of incidence is equal to the angle of reflection when a plane wave front is reflected by a plane surface.
- 25) Define work function. Write Einstein's photoelectric equation and explain the terms. ✓
- 26) Give three differences between intrinsic and extrinsic semiconductors. ✓

(15)

PART – D

IV. Answer **any two** of the following questions :

(2 × 5 = 10)

- 27) Derive the expression for conductivity of a material : $\sigma = \frac{ne^2\tau}{m}$; where the terms have their usual meaning.
- 28) Obtain the expression for the force between two straight long parallel conductors carrying current. Hence define "ampere". ✓
- 29) With the help of a labelled diagram, derive the expression for instantaneous emf induced in an AC generator. ✓

(10)

V. Answer **any two** of the following questions :

- 30) Obtain the expression for the fringe width of interference fringes in Young's Double slit experiment. ✓
- 31) Using Bohr's postulates, derive the expression for the radius of n^{th} stationary orbit of electron in hydrogen atom. Hence write the expression for Bohr radius. ✓
- 32) What is rectification? Explain the working of a p-n junction diode as a half wave rectifier. Draw the input and output wave forms. ✓

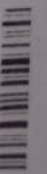
(10)
(3 × 5 = 15)

VI. Answer **any three** of the following questions :

- 33) Two point charges $q_A = 5\mu\text{C}$ and $q_B = -5\mu\text{C}$ are located at A and B separated by 0.2 m in vacuum.
- a) What is the electric field at the midpoint O of the line joining the charges? ✓
- b) If a negative test charge of magnitude 2nC is placed at O, what is the force experienced by the test charge? (5)
- 34) a) Three resistors 3Ω , 4Ω and 12Ω are connected in parallel. What is the effective resistance of the combination?
- b) If the combination is connected to a battery of emf 6 V and internal resistance 0.5Ω , find the current drawn from the battery and terminal potential difference across the battery. (5)
- 35) A series LCR circuit contains a pure inductor of inductance 5.0 H, a capacitor of capacitance $20\mu\text{F}$ and a resistor of resistance 40Ω .
- a) Find the resonant frequency of the circuit.
- b) Calculate the Quality factor (Q-factor) of the circuit.
- c) What is the impedance at resonant condition?

33 (NS)

-10-



36)

At what angle should a ray of light be incident on the face of an equilateral prism, so that it just suffers total internal reflection at the other face? The refractive index of the material of the prism is 1.5.

37)

A copper coin has a mass of 63.0 g. Calculate the nuclear energy that would be required to separate all the neutrons and protons from each other. The coin is entirely made of ${}_{29}^{63}\text{Cu}$ atoms.

Mass of ${}_{29}^{63}\text{Cu}$ atom = 62.92960 u

Mass of proton = 1.00727 u

Mass of neutron = 1.00866 u

Avogadro's number = 6.022×10^{23}
