



(English Version)

- Instructions :**
1. All Parts are compulsory.
 2. For Part – A questions, only first written answers will be considered for evaluation.
 3. Answers without relevant diagram / figure / circuit wherever necessary will not carry any marks.
 4. Direct answers to numerical problems without detailed solutions will not carry any marks.
 5. For question having circuit diagram / figure / graph, alternate questions are given at the end of the question paper in a separate section for visually challenged students.

PART – A

- I. Pick the correct option among the four options for **all** of the following questions : (15 × 1 = 15)

- 1) The electric dipole placed in uniform electric field is unstable, if the angle between electric field and dipole moment is
 - a) 0°
 - b) 60°
 - c) 90°
 - d) 180°
- 2) The capacitance of a capacitor is 6×10^{-6} farad. It is connected to 200 volt cell. The energy released on discharging it fully, will be
 - a) 0.12 J
 - b) 0.24 J
 - c) 0.6 J
 - d) 12 J



- 3) The current density is a
- a) scalar and its SI unit is $A m^2$
 - b) vector and its SI unit is A / m^3
 - c) vector and its SI unit is A / m^2
 - d) scalar and its SI unit is A / m
- 4) A current I flows along the length of an infinitely long, straight thin walled pipe, then the magnetic field
- a) at all points inside the pipe is same but not zero
 - b) at any point inside the pipe is zero
 - c) is zero only on the axis of the pipe
 - d) is different at different points inside the pipe
- 5) The universal property among all substances is
- a) Diamagnetism
 - b) Paramagnetism
 - c) Ferromagnetism
 - d) Non-magnetism
- 6) A bar magnet is kept along the axis of a circular coil. If the magnet is rotated about its axis, then
- a) a current will be induced in the coil
 - b) no current will be induced in the coil
 - c) an emf and current both will be induced in the coil
 - d) only an emf will be induced in the coil
- 7) Current in a coil changes from 1.6 A to 0.2 A in 2 second inducing an emf of 2.8 V. The value of self-inductance of the coil is
- a) 40 H
 - b) 28 H
 - c) 4 H
 - d) 56 H



- 8) The resonance phenomenon is exhibited by a circuit only if following components are present
- a) L and R
 - b) R and C
 - c) L and C
 - d) None of the above
- 9) According to the generalised Ampere-Maxwell law, $\oint \mathbf{B} \cdot d\mathbf{l}$ is equal to
- a) $\mu_0 i_c + \mu_0 \epsilon_0 \frac{d\phi_E}{dt}$
 - b) $\mu_0 i_c$
 - c) $\epsilon_0 \frac{d\phi_E}{dt}$
 - d) $\mu_0 \epsilon_0 \frac{d\phi_E}{dt}$
- 10) Modern telescopes called reflecting telescopes use a concave mirror rather than a lens for the objective because
- I. no chromatic aberration in a mirror.
 - II. giving mechanical support to a mirror is easier.
- a) I is true, II is false
 - b) I is false, II is true
 - c) Both I and II are true
 - d) Both I and II are false
- 11) According to Huygen's principle, the speed of the secondary wavelets is
- a) twice that of the wave
 - b) zero
 - c) same as the wave
 - d) infinite
- 12) Macroscopic particles in our daily life do not show wave-like properties because
- a) they are not associated with waves
 - b) their wavelength is extremely high
 - c) their wavelength is zero
 - d) their wavelength is negligibly small



- 13) At the distance of closest approach of an α - particle with gold nucleus,
- a) both kinetic energy and potential energy are equal
 - b) entire kinetic energy is converted into potential energy
 - c) entire potential energy is converted into kinetic energy
 - d) both kinetic energy and potential energy are zero
- 14) The nuclear force is
- a) attractive for distance $r = 0.5 \text{ fm}$
 - b) attractive for distance $r < 0.8 \text{ fm}$
 - c) repulsive for distance $r > 0.8 \text{ fm}$
 - d) repulsive for distance $r < 0.8 \text{ fm}$
- 15) p -type semiconductor is electrically
- a) positive
 - b) negative
 - c) neutral
 - d) as temperature increases it becomes negative

II. Fill in the blanks by appropriate answer given in the bracket for **all** the following questions : (5 × 1 = 5)

(decreasing, interference, helium, greater, diffraction, increasing)

- 16) The torque on a rectangular current loop in a uniform magnetic field increases by _____ the area of the loop.
- 17) The mutual inductance of a solenoid can be decreased by _____ the number of turns per unit length either in inner or outer solenoid.
- 18) Fringes of unequal intensities are obtained in _____ pattern.
- 19) Alpha particle is a _____ nucleus.
- 20) The value of energy band in insulators is _____ than 3 eV.

PART – B

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

(5 × 2 = 10)

- 21) State and explain Gauss's law in electrostatics.
- 22) Two point charges $5 \times 10^{-8} \text{C}$ and $-3 \times 10^{-8} \text{C}$ are located 10 cm apart. Find the point between the two charges where potential is zero.
- 23) When the force experienced by a moving charge in magnetic field becomes
 - a) maximum
 - b) minimum?
- 24) Define susceptibility and magnetisation for a magnetic material.
- 25) Write the principle of AC generator. Mention the expression for induced emf in it.
- 26) Give any two sources of energy loss in actual transformer.
- 27) Mention any two applications of UV (Ultraviolet) rays.
- 28) What is power of a lens? Write its SI unit.
- 29) Distinguish between intrinsic and extrinsic semiconductors.

PART – C

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

(5 × 3 = 15)

- 30) Mention any three properties of the electric field lines.
- 31) Deduce $E = -\frac{dV}{dx}$ where, the terms have usual meaning.
- 32) Give any three limitations of Ohm's law.
- 33) Explain, how a galvanometer is converted into an voltmeter?



33 (NS)

- 34) Mention any three properties of paramagnetic materials.
- 35) Lenz's law is the consequence of law of conservation of energy. Explain.
- 36) Write Cartesian sign conventions adopted for measuring distances in reflection of light at spherical mirrors.
- 37) Write three postulates of Bohr's atom model.
- 38) Mass defect of ${}^7\text{N}^{14}$ is 0.11236 u . Calculate the binding energy and binding energy per nucleon in MeV.

PART – D

(3 × 5 = 15)

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

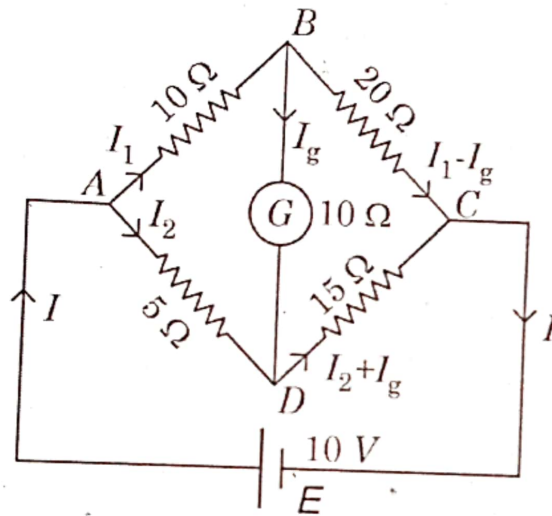
- 39) a) What are polar and non-polar molecules? (2)
b) Derive the expression for the capacitance of a parallel plate capacitor. (3)
- 40) Arrive the expressions for equivalent emf and internal resistance of two cells connected in series.
- 41) Deduce the expression for the magnetic field on the axis of a circular current loop.
- 42) a) What is the interference of light? (1)
b) Give the conditions for constructive and destructive interference of light in terms of path difference. (2)
c) Mention any two applications of Polaroids. (2)
- 43) Write Einstein's photoelectric equation. Using this, explain the experimental observations of photo electric effect.
- 44) What is a rectifier? Explain the working of p-n junction diode as a fullwave rectifier with circuit and input-output waveforms.

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

(2 × 5 = 10)

- 45) Two point charges $+15 \mu\text{C}$ and $-10 \mu\text{C}$ are separated by a distance of 20 cm in air. Calculate the electric field at the mid point of line joining two charges. If a point charge of 20 mC is placed at that mid-point, What is the magnitude of electric force experienced by it?

46)



In the given Wheatstone's network, calculate the value of electric current flowing through the galvanometer.

- 47) A sinusoidal voltage of 250 V and frequency 50 Hz, is applied to a series LCR circuit. In which, $R = 6 \Omega$, $L = 25 \text{ mH}$ and $C = 796 \mu\text{F}$. Calculate
- the impedance of the circuit and
 - the power factor.
- 48) A small bulb (a point source) is placed at the bottom of a tank containing water to a depth of 80 cm. What is the radius of the circular surface of water through which light emerge out? Refractive index of water is 1.33.



PART – E

(For Visually Challenged Students only)

46. In a Wheatstone's network ABCD, resistances $AB = 10 \, \Omega$, $BC = 20 \, \Omega$, $CD = 15 \, \Omega$ and $DA = 5 \, \Omega$ are connected in cyclic order. A cell of emf 10 V is connected between A and C. A galvanometer of resistance $10 \, \Omega$ is connected between B and D. Calculate the electric current flowing through the galvanometer.
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