PART I (40 marks)

Answer **all** *questions.*

Question 1.

(a) Read the following questions carefully. For each question there are four alternatives A, B, C and D. Choose the correct alternative and write it in the space provided. **[10]**

(i) When electric dipole of moment $\vec{p}$ is placed in a uniform field $\vec{E}$, it experiences a torque of

A $\vec{p}.\vec{E}$.

B $\vec{p}\times\vec{E}$.

C $\vec{E}.\vec{p}$.

D zero.

Answer: ……

(ii) Electromagnetic waves are produced by

A a static charge.

B a neutral particle.

C an accelerated charge.

D a uniformly moving charge.

Answer: ……

(iii) If the radius of the second electron orbit in hydrogen atom is r, then the radius of the third orbit will be

A $r/3$.

B 2.25 r.

C 3 r.

D 9 r.

Answer: ……

(iv) Pair-production means

A ionization of the neutral atom.

B ejection of electrons from a metal.

C ejection of neutrons from a nucleus.

D annihilation of a γ-ray into an electron and a positron.

Answer: ……

(v) A positively charged particle enters a uniform magnetic field with a uniform velocity. Suppose it makes an angle other than 90° and 0° with the direction of the field, then the path of the particle in the field will be

A helical.

B circular.

C parabolic.

D straight line.

Answer: ……

(vi) If a power of 100W is supplied across a potential difference of 200V, the current flowing through the circuit will be

A 0.5A.

B 1A.

C 2A.

D 20A.

Answer: ……

(vii) The earth's magnetic field always has a horizontal component ***EXCEPT*** at

A the poles.

B the equator.

C the magnetic axis.

D both the equator and poles.

Answer: ……

(viii) The refractive index of glass with respect to air is 1.5 and that of water is 1.33. The critical angle for glass and water pair will be

A 45°.
B 60°.
C 63°.
D 90°.

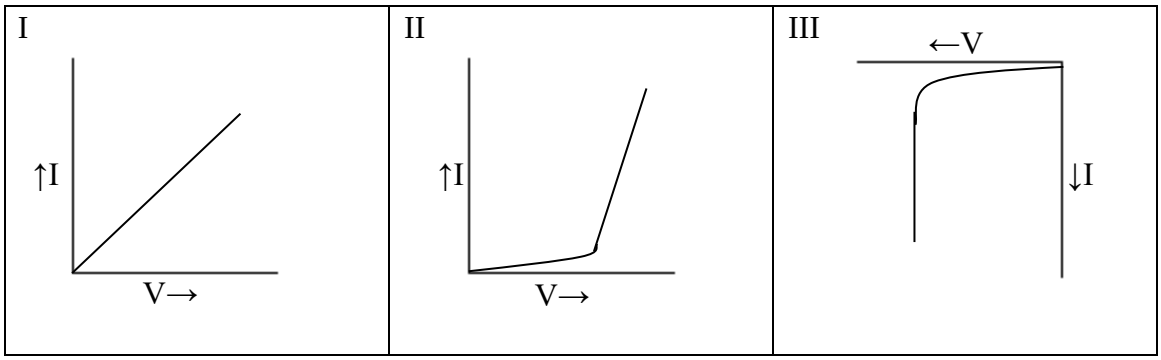
Answer: ……

(ix) The binding energy per nucleon is plotted as a function of atomic mass number. Compared to the other elements, the curve for helium nucleus will have a sharp maximum. This indicates that helium

A is very stable.
B is radioactive.
C fuses very easily.
D fissions very easily.

Answer: ……

(x) The forward biased characteristics of p-n junction diode is illustrated by:



A I.
B II.
C III.
D II and III.

Answer: ……

(b) ***Match each item of Column A with the most appropriate item of Column B. Rewrite the correct pairs by writing the number and the corresponding alphabet in the spaces provided. For example, (i) – (xi)*** **[4]**

Column A	**Column B**
(a) α-scattering	i. $k\tan\theta$
(b) Gauss theorem	ii fusion
(c) Nuclear reactor	iii. $\mu_o i$
(d) Constructive interference	iv. nucleus
(e) Half life	v. q/ε_0
(f) Ampere's circuital law	vi. $\frac{0.693}{\lambda}$
(g) Huygen's principle	vii. $n\lambda$
(h) Tangent galvanometer	viii. wave front
	ix. $(2n-1)\lambda$
	x. E/A
	xi. fission

……

……

……

……

……

……

……

……

……

……

……

(c) Choose the correct word/s given in the brackets and write them in the space provided. **[6]**

(i) Two magnetic fields in tangent law are ……. to each other and its concept is used in ……. magnetometer. (*deflection/parallel /vibration/perpendicular*)

(ii) ……. method is used to determine the speed of light and its nine digit value is ……. ms^{-1}. (*Thomson's/299793458/299792458/Michelson's*)

(iii) The ……. potential of collector plate relative to emitter plate at which the photoelectric current becomes ……. is called 'stopping potential'. (*positive/negative/zero/maximum*)

(iv) LED is a ……. biased p-n junction and ……. is used to convert a.c. to d.c. (*amplifier/rectifier/reverse/forward*)

(v) A current loop behaves like a ……. dipole having that face as ……. through which the current appears to be flowing anticlockwise. (*north pole/electric/magnetic/south pole*)

(vi) Secondary rainbow is produced due to ……. total internal reflection and the inner most colour in primary rainbow is ……. (*red/violet/single/double*)

(d) Write True or False and give reasons for the false statements. **[4]**

(i) The capacitance of a conductor is the ratio of the current given to the rise in potential of the conductor.

……

……

……

(ii) The phenomenon of polarization proves the transverse nature of light.

……

……

……

(iii) Collector current is equal to the sum of base current and emitter current.

……

……

……

(iv) The difference between the combined mass of all nucleons and the mass of nucleus is a.m.u..

……

……

……

(e) Answer the following questions.

(i) How does the process of electric conduction in gases differ from electric conduction in metals? **[2]**

……

……

……

……

……

(ii) (a) Draw a logic symbol for NOR gate. **[1]**

(b) Define energy bands in solids. **[1]**

……

……

……

……

(iii) Do all metallic conductors follow Ohm's law? Give a reason to support your answer. **[2]**

……

……

……

……

(iv) How can the intensity and penetrating power of X-rays be controlled? **[2]**

……

……

……

……

(v) How much energy will be created if 1.0 g of matter is destroyed completely? **[2]**

(vi) Do photons have mass? Give a justification to support your answer. **[2]**

……

……

……

……

(vii) A 200 turns coil of self inductance 20 mH carries a current of 4 mA.
Find the magnetic flux linked with each turn of the coil. **[2]**

(viii) Draw a ray diagram of a refracting astronomical telescope when the final image is formed at infinity. **[2]**

PART II
SECTION A (28 marks)
Answer any **four** *questions.*

Question 2.

(a) State any ***two*** properties of magnetic field lines. **[2]**

……

……

……

(b) A train is moving with a uniform speed from north to south. Will any potential difference be induced between the ends of its axle? Support your answer with a reason. **[2]**

……

……

……

(c) Two point charges of 3×10^{-8} C and -2×10^{-8} C are located 15cm apart.
At what point on the line is the electric potential zero? **[3]**

Question 3.

(a) On moving away from a point charge, the electric field due to the charge decreases. This is also true for a small electric dipole. Does the electric field decrease at the same rate in both cases? Give the relation between electric field (E) and distance (r). **[2]**

(b) Find the expressions for the resistance of a conductor and the resistivity of a material. **[4]**

(c) A stationary charge experiences no magnetic Lorentz force. Why? **[1]**

……

……

……

Question 4.

(a) Explain the meaning of, **[2]**

(i) quantization of charge.

(ii) conservation of charge.

……

……

……

……

……

(b) A transformer cannot work on d.c. Why? **[2]**

……

……

……

……

(c) The values of magnetizing field and magnetic induction of an iron bar are 1600 Am^{-1} and 1.2 $NA^{-1}m^{-1}$ respectively. Calculate permeability and susceptibility of the bar. **[3]**

Question 5.

(a) What is Seebeck effect? How does the thermo-emf vary with the temperature of the hot junction? **[3]**

……

……

……

……

……

……

……

……

……

(b) Using Biot-Savart's law, derive an expression for magnetic field intensity produced at a point due to the current flowing through a long straight conductor. **[4]**

Question 6.

(a) Why do electric lines of force never intersect each other? **[2]**

……

……

……

……

(b) Can a current carrying loop rotate in a uniform magnetic field? Give reasons to support your answer. **[2]**

……

……

……

……

(c) A 80 Ω resistor is connected to 240 V-55 Hz a.c. supply. Find the rms value of current in the circuit and the net power consumed for a complete cycle. **[3]**

Question 7.

(a) Explain the working of a suspended type moving coil galvanometer. **[3]**

(b) Obtain the balanced condition of a Wheatstone bridge. **[3]**

(c) What is meant by the angle of dip? **[1]**

……

……

SECTION B (18 marks)

Answer any **three** *questions.*

Question 8.

(a) Derive an expression for the angular width of the central maximum of the diffraction pattern with the help of a diagram. **[3]**

(b) What are the advantages of a reflecting telescope over refracting telescope? **[3]**

……

……

……

……

……

……

Question 9.

(a) What is meant by band spectrum? **[1]**

……

……

……

……

(b) Does a ray of light passing through the optical centre of lens suffer deviation? Justify your answer. **[2]**

……

……

……

……

(c) How are infra-red rays and X-rays produced? **[2]**

……

……

……

……

(d) What is the magnifying power of a simple microscope made of convex lens of focal length f=10 cm with the final image at infinity? **[1]**

Question 10.

(a) Write ***three*** differences between constructive interference and destructive interference. **[3]**

Constructive interference	**Destructive interference**

(b) Derive lens maker's formula for a thin lens. **[3]**

Question 11.

(a) In a Young's double slit experiment, interference fringes were produced on a screen placed at 1.5 m from the two slits, 0.2 mm apart and illuminated by light of $6300\,\text{Å}$. Find the fringe width. **[2]**

(b) Explain briefly how the illuminating powers of two sources of light are compared using Bunsen's grease spot photometer. **[2]**

(c) (i) Write down the condition for achromatism for thin lenses in contact. **[1]**

……

……

(ii) Write down the relation between the angle of emergence and the angle of deviation of a light ray passing through a prism. **[1]**

……

……

SECTION C (14 marks)

Answer any **two** *questions.*

Question 12.

(a) Give ***two*** uses of radio isotopes. **[2]**

……

……

……

……

(b) Obtain the expression of momentum of photon. **[3]**

(c) Explain energy generation in nuclear fusion reaction. **[1]**

……

……

……

(d) Define depletion region for a p-n junction diode. **[1]**

……

……

Question 13.

(a) A transistor is a temperature-sensitive device. Explain. **[2]**

……

……

……

……

(b) Calculate the maximum frequency and minimum wave length of X-rays produced in a tube maintained at 12.5kV. **[3]**

(c) Distinguish between the nature of positron and electron. What interaction takes place when they come near? **[2]**

……

……

……

……

Question 14.

(a) Compared to other particles, neutrons are considered as ideal particles for nuclear fission reaction. Why? **[2]**

……

……

……

(b) Draw a circuit diagram of a full wave rectifier using p-n junction diodes and show its input and output wave forms. **[3]**

(c) What is the difference between Rutherford's model and Bohr's model of an atom? **[1]**

Rutherford's model of an atom	**Bohr's model of an atom**

(d) Write down the expression for Compton shift. **[1]**

……

……

[PHYSICAL CONSTANTS]

Planck's constant	$h = 6.63 \times 10^{-34}$J.s
Electron charge	$e = 1.6 \times 10^{-19}$ C
1 electron volt	$1eV = 1.6 \times 10^{-19}$ J
Speed of electromagnetic wave	$c = 3 \times 10^{8}$ ms^{-1}
Energy equivalent of	1u = 931 MeV
Mass of an electron	$M_e = 9.1 \times 10^{-31}$ kg
	$\varepsilon_0 = 8.85 \times 10^{-12} C^2N^{-1}m^{-2}$
	$\mu_0 = 4\pi \times 10^{-7}$ TmA^{-1}
	$\pi = 3.14$

***for* ROUGH WORK**

***for* ROUGH WORK**

***for* ROUGH WORK**