

General Instructions

- 1) All Questions are compulsory
- 2) Section A has 5 questions of 1 mark each
- 3) Section B and C are of 5 and 12 questions each of 2 marks and 3 marks respectively.
- 4) Section D is of 1 question of 4 marks and section E of 3 questions each 5 marks. Internal choice is given in this section. Use of calculators is prohibited.

SECTION A

- 1) What will be the change in a wire, when its radius is halved and length is reduced to one fourth of its original length?
- 2) A light of intensity I passes through a Polaroid. What is the intensity of light transmitted?
- 3) Show graphically how the stopping potential for a given photosensitive surface varies with the frequency of incident radiation.
- 4) What are two modes of communication?
- 5) Using the concept of force between two infinitely long parallel current carrying conductors define one ampere of current.

Section B

- 6) To which part of the electromagnetic spectrum does a wave of frequency 3×10^{13} Hz belong?
- 7) Estimate the average drift speed of conduction electrons in a copper wire of cross sectional area $2.5 \times 10^{-7} \text{ m}^2$ carrying current of 1.8 A. Assume the density of electrons to be $9 \times 10^{28} \text{ m}^{-3}$.
- 8) Considering the case of parallel plate capacitor being charged show how one is required to generate Ampere's circuital law to include the term due to displacement current.
- 9) Violet light is incident on a converging lens of focal length ' f '. State with reason how the focal length of the lens will change, if the violet light is changed to red light.
- 10) Two point charges $10 \mu\text{C}$ and $40 \mu\text{C}$ are placed 10 cm apart in vacuum. What will be the net field at a point midway between them?

SECTION C

- 11) Using Bohr's postulates of the atomic model derive the expression for radius of n th electron orbit. Hence obtain the expression for Bohr's radius.
- 12) Define terminal potential difference of a cell. Derive a relation between the internal resistance, emf and terminal potential difference.
For driving a current of 3 A for 5 minutes in an electric circuit 900 J of work is to be done. Find the emf.
- 13) Derive an expression for the torque acting on a current carrying loop suspended in a uniform magnetic field. Calculate the torque on a 100 turn rectangular coil of length 40 cm and breadth 20 cm carrying a current of 10 A when placed making an angle of 60° with a magnetic field of 3 T.
- 14) Derive an expression for the refractive index of the material of the prism in terms of the angle of the prism and angle of minimum deviation. A ray of light incident on an equilateral glass prism shows a minimum deviation of 30° . Calculate the speed of light through the prism.
- 15) State and explain the law of Malus. If the angle of the pass axis of polarizer and the analyser is 45° write the ratio of the intensities of the original and the transmitted light after passing through the analyser.
- 16) What considerations led de-Broglie to suggest that material particles can have wave propagation? Derive de-Broglie wave equation for material particles.

- 17) With the help of a circuit diagram explain full wave rectification using junction diodes. Draw the wave forms of input and output voltages.
- 18) What is mass defect of a nucleus? Express it mathematically. Calculate the binding energy per nucleon of Ca whose mass number is 40 and atomic number 20. Given that $m_n = 1.008665$, $m_p = 1.007825$ and m of Ca is 39.962589 amu.
- 19) An angular magnification (magnifying power) of 30X is desired using an objective of focal length 1.25 cm and an eyepiece of focal length 5 cm. How will you set up the compound microscope?
- 20) What is amplitude modulation? Draw an A.M wave. Give its important features.
- 21) Using phasor diagram, derive an expression for the impedance of a series LCR circuit. Calculate the impedance of an LCR circuit if the reactance of C and L are 250Ω and 220Ω respectively and R is 40Ω .
- 22) What is coefficient of coupling? Derive an expression for the mutual inductance of two long coaxial solenoids. State the factor on which mutual inductance depends.

SECTION D

- 23) Anita and her friends visited an exhibition. There policeman asked them to pass through a metal detector. Anita's friends were scared of it. Anita convinced them and explained the purpose and working of the metal detector.
 - i) What qualities does Anita possess?
 - ii) What is metal detector and how does it work?

SECTION E

- 24) Deduce Coulomb's law from Gauss law.
A spherical conductor of radius 12 cm has a charge of 1.6×10^{-7} C distributed uniformly over its surface. What is the electric field i) inside the sphere ii) just outside the sphere iii) at a point 18 cm from the centre of the sphere.

OR

- a) Two extremely small charged copper spheres have their centres separated by a distance of 50 cm in vacuum. What is the mutual force of repulsion if the charge on each is 6.5×10^{-7} C?
- b) What will be the force of repulsion if i) the charge of each sphere is doubled and their separation is halved? ii) the two spheres are placed in water of $K = 80$.
- 25) Draw a circuit for an n-p-n transistor in common emitter configuration to study its i) input characteristics ii) output characteristics. Draw approximate shapes of these curves and give their important features. How will you use these characteristics to obtain i) input resistance ii) output resistance iii) current amplification factor.

OR

With the help of a labeled circuit diagram explain the use of n-p-n transistor as common emitter amplifier. Write expressions for the various gains of a common emitter amplifier.

- 26) Deduce an expression for fringe width in Young's double slit experiment. How can the wavelength of Monochromatic light be found by this experiment.

OR

What is Diffraction of light? Deduce expressions for i) angular width of central maxima ii) linear width of central maxima iii) linear width of secondary maximum.