

General Instructions:-

1. All questions are compulsory.
2. There is no overall choice. However, an internal choice has been provided in one question of two marks, one question of three marks and one question of five marks. You have to attempt only one of the choices in such questions.

3. Question numbers 1 to 5 are very short answer questions, carrying 1 mark each.

4. Questions 6 to 12 are short answer questions each carrying 2 marks..

5. Questions 13 to 24 are also short answer questions each carrying 3 marks.

6. Questions 25 to 27 are long answer questions each carrying 5 marks.

7. Use of calculators is not permitted. However, you may use log tables, if necessary.

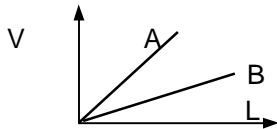
8. You may use the following physical constant, wherever necessary:

$$c = 3 \times 10^8 \text{ m/s}$$

$$h = 6.6 \times 10^{-34} \text{ Js}$$

$$e = 4\pi \times 10^{-7} \text{ Tm A}^{-1}$$

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1. What is the value of angle of dip at the place where the horizontal component of the earth's magnetic field is $\sqrt{3}$ times the vertical component? (1)
2. The variation of p.d with length in the case of two potentiometers A and B is given below. Which of the two is more sensitive?



3. Define magnetic susceptibility. (1)
4. What is Poynting vector? (1)
5. If the doping level of the base region of a transistor is increased, what happens to its collector current and why? (1)
6. A charged particle enters a uniform magnetic field with a velocity perpendicular to the field direction. Explain the reason for no variation of its kinetic energy. (2)
7. Light of wavelength 589nm from a distant source is incident on a slit 1.0mm wide and the resulting diffraction pattern is observed on a screen 2.0m away. What is the distance between the two dark fringes on either side of the central bright fringe? If the entire apparatus is immersed in water, what will be the distance between the two dark fringes? (2)
8. Show that the angle of minimum deviation produced by a thin prism is reduced to one fourth when it is immersed in water. Given: $\mu_g = 3/2$ and $\mu_w = 4/3$. (2)
9. State Rayleigh scattering law. How does it explain blue colour of the sky? (2)
10. The half-life of a radioactive material is 1600 years. After how many years 75 %of the initial material will be decayed? (2)
11. Explain the process of remote sensing. Mention any two major applications of remote sensing. (2)
12. What should be the height of a T.V tower so that the T.V broadcast covers a total population of 60.32 lakhs. (given: Radius of earth = 6.4×10^6 m and the average population density = 1000 km^{-2}) (2)
13. Three concentric spherical metal shells A,B and C of radii a, b and c ($a < b < c$) have surface charge densities $+\sigma$, $-\sigma$ and $+\sigma$ respectively. Find the potentials on three shells A, B and C. (3)

(OR)

13. Plot a graph between charge stored and potential difference between the plates of a capacitor. Hence derive an expression for the energy stored in the capacitor. (3)
14. Explain the experimental method of comparison of resistances of two wires using the Wheatstone's principle. (3)
15. Determine the potential drop between X and Y in the circuit shown below: (3)

16. Explain the action of a lead acid accumulator, with the help of a diagram. (3)
17. What are neutral points? Plot the lines of force around a magnet when placed with its north pole pointing north of the earth, indicating the location of neutral points and corresponding equation. (3)
18. An alternating voltage $E = 200 \sin 300t$ is applied across a series combination of $R = 10\Omega$ and an inductor 800mH. Calculate: (3)
- (i) Impedance of the circuit.
- (ii) Peak value of current
- (iii) Power factor of the circuit.

(OR)

18. A magnetic field of induction 2T acts at right angle to the coil of area 100cm^2 with 500 turns and having a resistance of 10Ω . The coil is removed at uniform rate from the field in 0.1 second. Determine: (3)
- (i) The induced e.m.f

- (ii) The induced current
- (iii) The induced charge (3)

19. State the principle of superposition of waves. On the basis of it, obtain the expression for the resultant intensity when two waves interfere each other. (3)
20. An object is placed between F and $2F$ of a double convex lens. Draw the ray diagram to show its image formation and derive an expression relating the object distance, image distance and its focal length. (3)
21. Using a truth table and circuit diagram, explain how can OR gate be realized in practice. (3)
22. With the help of a circuit diagram, describe how can a transistor be used as an amplifier in common base configuration. Explain the phase relationship between input and output. (3)
23. What is Pogsson's ratio? Distinguish between absolute and apparent magnitude of a star. If the sudden outburst in a star changes its magnitude from $+2$ to -3 , by how much will brightness change? (3)
24. Describe how does a LASER work? How is the light from a LASER different from that of LED? (3)
25. What is an electric dipole? Derive an expression for the intensity of electric field at a point on (i) the axial line and (ii) the perpendicular bisector of an electric dipole. Hence show that the intensity of field due to a short dipole at a point on the axial line is twice that at its perpendicular bisector. (5)
26. Describe, with the help of neat labeled diagram, the principle, construction and working of a step-up transformer. Mention any two forms of energy losses in the transformer. (5)
27. (i) What are matter waves? How did Davisson and Germer verify the existence of such waves?
(ii) Show that the de-Broglie wavelength associated with a moving electron under a potential difference of ' V ' is inversely proportional to the square root of the potential difference. (3+2=5)

(OR)

27. (i) State the laws of photoelectric emission. Draw the graphical variation of photoelectric current with applied voltage for different frequencies, but having the same intensity of radiations.
(ii) For photoelectric effect in sodium, what does slope of the graph between maximum kinetic energy and incident frequency give? Will this value change on changing the metal. (3+2 =5)