General Instructions:

1. All questions are compulsory.

2. There is no overall choice. However, an internal choke has been pro vided in one question of two marks, one question of three marks and all three questions of five marks. You have to attempt only one of the chokes in such questions.

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

4. Question numbers **6** to **12** are short answer type questions, carrying **two** marks each.

5. Question numbers **13** to **24** are also short answer type questions, carrying **three** marks each.

6. Question numbers **25** to **27** are long answer type questions, carrying **five** marks each.

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

8. You may Use the following values of physical constants wherever necessary:

PHYSICS 2005 Compartment (Outside Delhi)

Q1. Write one condition under which an electric charge does not experience a force in a magnetic field.   1

Q2. Write S I unit of magnetic field.   1

Q3. When a lamp is connected to an alternating voltage supply, it lights with the same brightness as when connected to a 12V DC battery. What is the peak value of alternating voltage source?   1

Q4. Why is the conductivity of n-type semiconductor greater than that of the p-type semiconductor even when both of these have same level of doping?   1

Q5. Name the process by which exact reproduction of a document at a distant place can be received.   1

Q6. Define the term 'temperature coefficient of receptivity'. Show graphically the variation of receptivity with temperature for nichrome.   2

Q7. Write the expression for frequency of an ideal LC circuit. In an actual circuit, why do the oscillations ultimately die away? **2**

Q8. Monochromatic light is refracted from air into glass .of refractive index n, Find the ratio of wavelengths of the incident and refracted light. **2**

Or Write two conditions necessary for total internal reflection to take place.

Q9. An electron and a proton have the same kinetic energy. Which of the two has a greater wavelength? Explain. **2**

Q10. Define the term threshold frequency and work function in relation to Photoelectric effect. **2**

Q11. Two signals A and B' shown in the figure are used as two inputs of an AND gate. Obtain its output wave form. Draw the logic symbol of AND gate. **2**
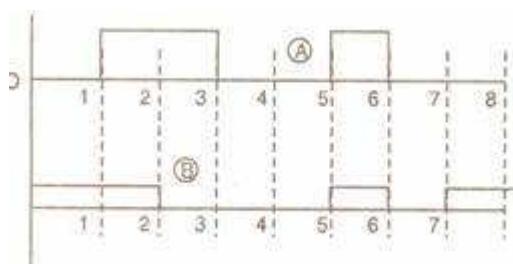
Q12. With the help of diagrams distinguish between forward biasing and reverse biasing of a p-n diode. **2**

Q13. A system has two charges q_A = 2.5 x 10 -7 C and q_B = - 2.5 x 10 -7 C located at points A (0, 0, - 15 cm) and B (0, 0, + 15 cm) respectively. Calculate the electric dipole moment of the system. What is its direction? **3**

Q14. A battery of emf 10 V and internal resistance 3Ω is connected to a resistor R. (a) If the current in the circuit is 0.5 A, calculate the value of R. (b) What is the terminal voltage of the battery when the circuit is closed? **3**

Q15. With the help of circuit diagram explain in brief the use of a potentiometer for comparison of emf of two cells. **3**

Q16. How will a diaper and a Ferro-magnetic material behave when kept in a non-uniform external magnetic field? Give one example of each of these materials.   **3**

Q17. With the help of a labelled diagram explain in brief the working of a cyclotron.**3**

Q18. Name the radiations of electromagnetic spectrum which are used in
(a) warfare to look through fog.
(b) radar and geostationary satellites.
(c) studying the structure and properties of atoms and molecules.   **3**

Q19. Using Huygen's principle, explain the refraction of a plane wave front at a plane surface. Hence prove Snell's law.   **3**

Or The figure given below shows an experimental set up for Young's double slit experiment to observe interference of light on the screen OP.

Here path difference SS 2 - SS 1 = $\lambda/4$. Obtain the condition for (i) constructive, and (ii) destructive interference at any point P in terms of path difference, $\Delta = S_2P - S_1P$.

Q20. Draw a labelled diagram of experimental setup of Rutherford's alpha particle scattering experiment. Write two important inferences drawn from this experiment.   **3**

Q21. The sequence of stepwise decays of a radioactive nucleus is

$$D \xrightarrow{\alpha} D_1 \xrightarrow{\beta} D_2 \xrightarrow{\alpha} D_3$$

If the nucleon number and atomic number for D2 are 176 and 71 respectively, what are the corresponding values of D and D3? Justify your answer in each case.   **3**

Q22. Explain the term remote sensing in communication. Name the satellite used for this purpose. Mention its any two applications.   **3**

Q23. Explain the terms (i) pulse-amplitude modulation (PAM) and (ii) pulse-code modulation (PCM). Which modulation is preferred in transmitting signals and why?   3

Q24. Explain, with the help of a circuit diagram, the use of n-p-n transistor as an amplifier in common emitter configuration.   3

Q25. A dielectric slab of thickness 't' is kept in between the plates, each of area 'A', of a parallel plate capacitor separated by a distance 'd'. Derive an expression for the capacitance of this capacitor for t << d.   5

Or (a) Explain briefly how a capacitor stores energy on charging. Obtain an expression for the energy thus stored.
(b) A battery of 10 V is connected to a capacitor of 0.1 F. The battery is now removed and the capacitor is then connected to a second uncharged capacitor of same capacitance. Calculate the total energy stored in the system.

Q26. Draw a labelled diagram of a compound microscope when the image is formed at infinity. Deduce the expression for its magnifying power. How can the magnifying power be increased?

Or Draw a labelled diagram to show the image formation in an astronomical telescope. Write an expression for its magnifying power.   5

Why should the objective lens of such a telescope have large diameter?

Q27. With the help of a neat and labelled diagram, explain the principle, construction and working of an a.c. generator.   5

Or Explain, with the help of a neat and labelled diagram, the principle, construction and working of a transformer.