2022
PHYSICS

Total marks : 70 Time : 3 hours

General instructions:

i) Approximately 15 minutes is allotted to read the question paper and revise the answers.

ii) The question paper consists of 30 questions. All questions are compulsory.

iii) Marks are indicated against each question.

iv) Internal choice has been provided in some questions.

N.B: Check to ensure that all pages of the question paper is complete as indicated on the top left side.

1. A positively charged glass rod is brought near an uncharged pitt ball pendulum. The pitt ball is **1**

   (a) attracted towards the rod (b) repelled away from the rod
   (c) not affected by the rod (d) attracted towards the rod, touches it and is then thrown away from it.

2. Electromagnetic waves of which of the following wavelengths represents an infrared wavelength? **1**

   (a) 10^{-4}cm (b) 10^{-5}cm
   (c) 10^{-6}cm (d) 10^{-7}cm.

3. If the intensity of incident radiation is doubled, the kinetic energy of emitted photoelectrons **1**

   (a) remains same (b) becomes one-fourth
   (c) becomes two times (d) become four times.

4. Which of the following frequencies will be suitable for beyond the horizon communication of using sky waves? **1**

   (a) 10 KHZ (b) 10 MHZ
   (c) 1 GHZ (d) 1000 GHZ.

5. The material which is used as a moderator in nuclear reactor is **1**

   (a) uranium (b) heavy water
   (c) cadmium (d) plutonium.

6. **a.** A polythene piece rubbed with wool is found to have a negative charge of $3x10^{-7}$C. Estimate the number of electrons.

   Or **1**

   b. Write any two properties of electric field lines.

7. Define drift velocity. **1**

8. How should a polarizer and an analyzer be placed so that intensity is maximum? **1**

9. Calculate the frequency associated with a photon of energy 3.3×10^{-20}J. (given h= 6.6×10^{-34}JS). **1**

10. **a.** Give two examples of communication system that use space wave mode of propagation.

Or **1**

b. What is the function of transducer in a communication system?

11. **a.** A metallic wire of length *'l'* and resistance of 5Ω is stretched to double its length. Find its new resistivity and resistance.

Or **2**

b. Derive an expression for the internal resistance of a cell.

12. **a.** A voltage of 200V is applied across a colour coded carbon resistor with first, second and third rings of blue, black and yellow colours. What is the current in the circuit?

Or **2**

b. At room temperature (27.0°C), the resistance of a heating element is 100Ω. What is the temperature of the element if the resistance is found to be 117Ω, given that the temperature coefficient of the material of the resistor is 1.70×10^{-4}°C^{-1}·?

13. **a.** Explain with the help of a circuit diagram, how a galvanometer can be converted into an ammeter.

Or **2**

b. State two properties of a paramagnetic substances.

14. **a.** What is displacement current? Write the expression for Ampere's-Maxwell law.

Or **2**

b. What are X-rays? Write any two applications of X-rays.

15. **a.** Obtain the expression for the total energy of an electron according to Rutherford's model of an atom.

Or **2**

b. Draw and label the schematic arrangement of Geiger- Marsden experiment.

16. **a.** Which logic gate is also known as the universal gate? Write its truth table.

Or **2**

b. What are the two types of dopants used in doping the tetravalent Si or Ge? Give example.

17. **a.** State the coulomb's law in electrostatics. Show that coulomb's law is consistent with Newton's third law.

Or **3**

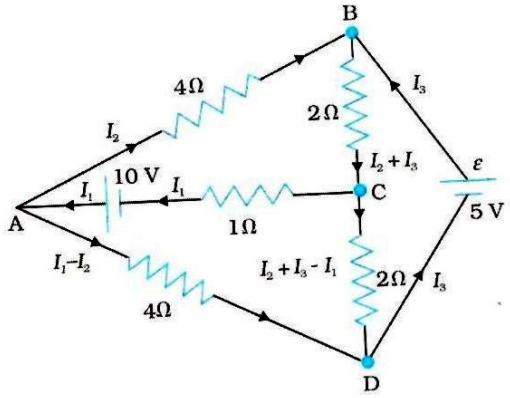
b. Derive an expression for the electric potential at any point due to an electric dipole.

18. **a.** Derive an expression for the potential energy of an electric dipole of dipole moment $\vec{P}$ placed in a uniform electric field.

Or **3**

b. Show that energy stored in a parallel plate capacitor is $\frac{1}{2}QV$.

19. **a.** Using Kirchoff's law, determine the value of I_1 of the network shown in the figure.



Or **3**

b. Obtain the expression for the resistances connected in series and parallel.

20. **a.** State Ampere's circuital law. Apply it to find the expression for magnetic field due to a long solenoid.

Or **3**

b. Derive the expression for the magnetic dipole moment of a revolving electron. Also define Bohr magneton.

21. **a.** Derive an expression for the force experienced by a current carrying straight conductor placed in a magnetic field.

Or **3**

b. Explain how a bar magnet act as an equivalent solenoid.

22. **a.** What are eddy currents? Explain how eddy currents are induced in the copper plate while entering and leaving the region of magnetic field and why is it undesirable?

Or **3**

b. Deduce an expression for the emf induced across the ends of a conductor moving in a perpendicular magnetic field.

23. **a.** Two lenses of power +15D and −5D are in contact with each other forming a combination lens.

i) What is the focal length of this combination?

ii) An object of size 3cm is placed at 30cm from this combination of lenses. Calculate the position and size of the image formed.

Or **3**

b. Define power of accommodation of human eye. What causes myopia eye? How can it be corrected?

24. **a.** Use Huygen's principle to verify the laws of reflection.

Or **3**

b. Draw a schematic diagram of Cassegrain telescope. Write any two advantages of it over refracting type telescope.

25. **a.** Obtain an expression for de-broglie wavelength of electron when accelerated through a potential difference v. Find the wavelength of the electron when v = 100V.

Or **3**

b. Derive Einstein's photoelectric equation.

26. **a.** State the radioactive decay law. Deduce the relation $N=N_o e^{-\lambda t}$, where symbols have their usual meanings.

Or **3**

b. Starting from the expression of energy of an electron in the nth state of a hydrogen atom, obtain relation for frequency and wavelength of emitted radiation. Hence, obtain a formula for Rydberg constant.

27. **a.** Explain any two factors which justify the need for modulating a signal.

Or **3**

b. A transmitting antenna at the top of a tower has a height 32m and the height of the receiving antenna is 50m. What is the maximum distance between them for satisfactory communication in LOS mode? (Given radius of earth 6.4×10^6m.)

28. **a.** What is impedance? Derive a relation for it in an a.c series LCR circuit. Also find an expression for resonance frequency of such circuit.

Or **5**

b. Explain the principle, construction and working of an a.c generator. Derive the expression for the induced emf produced.

29. **a.** Derive the expression for the fringe width in Young's double slit interference. Show that bright and dark fringes are equally spaced.

Or **5**

b. Explain the formation of secondary maxima and minima due to diffraction from a single slit with the help of a ray diagram. Why do the central maximum has maximum intensity?

30. **a.** What is a transistor? Explain the action of an npn and pnp transistor.

Or **5**

b. What is a zener diode? Explain its mechanism. With figure, explain how a zener diode can be used as a voltage regulator?

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