|  |  |  |  |
| --- | --- | --- | --- |
| **A close-up of a sign  Description automatically generated** | | | |
| **UT/PHQP/1223/A 30-OCT-2023** | | | |
| **UNIT TEST (2023-24)** | | | |
| **Subject: PHYSICS**  **Grade: XII** | **Max. Marks:50**  **Time: 2 ½ Hours** | | |
| **Name:** | | **Section:** | **Roll No:** |

|  |  |  |  |
| --- | --- | --- | --- |
|  | **SECTION A** | |  |
|  | The direction of induced current in the loop abc is : | | 1 |
|  | a) along abc if I decreases | b) along acb if I increases |  |
|  | c) along abc if I is constant | d) along abc if I increases |  |
|  | A square shaped coil of side 10 cm, having 100 turns is placed perpendicular to a magnetic field which is increasing at 1 T/s. The induced emf in the coil is | | 1 |
|  | a) 0.1 V | b) 0.5 V |  |
|  | c) 0.75 V | d) 1.0 V |  |
|  | An inductor, a capacitor and a resistor are connected in series across an ac source of voltage. If the frequency of the source is decreased gradually, the reactance of : | | 1 |
|  | a) both the inductor and the capacitor decreases. | b) inductor decreases and the capacitor increases. |  |
|  | c) both the inductor and the capacitor increases. | d) inductor increases and the capacitor decreases. |  |
|  | The electromagnetic radiations used to kill germs in water purifiers are called : | | 1 |
|  | a) Infrared waves | b) X-rays |  |
|  | c) Gamma rays | d) Ultraviolet rays |  |
|  | The magnification of a compound microscope for the final image at the least distance of distinct vision is 90.The magnification of objective lens is 15.The value of the focal length of the eyepiece will be | | 1 |
|  | a) 5 cm | b) 6 cm |  |
|  | c) 1/6 cm | d) 12 cm |  |
|  | An equiconvex lens is cut into two halves along case (i) XOX' and case (ii) YOY' as shown in the figure.  69478  Let f be the focal length of complete lens , f ' be the focal length of each half in case (i) and f " be the focal length of each half in case (ii). Choose the correct statement from the following- | | 1 |
|  | a) f ' = f , f " =2f | b) f ' = 2f , f " = f |  |
|  | c) f ' = f , f " = f | d) f ' = 2f , f " =2f |  |
|  | Hydrogen atom initially in the ground state, absorbs a photon which excites it to n = 5 level. The wavelength of the photon is : | | 1 |
|  | a) 975 nm | b) 740 nm |  |
|  | c) 523 nm | d) 95 nm |  |
|  | The difference in mass of **7X** nucleus and total mass of its constituent nucleons is 21·00 u. The binding energy per nucleon for this nucleus is equal to the energy equivalent of : | | 1 |
|  | a) 3u | b) 3.5u |  |
|  | c) 7u | d) 21u |  |
|  | Question Nos. 9 to 10 are Assertion (A) and statements Reason (R) type questions.  Given below are two statements labelled as Assertion (A) and Reason (R).  Select the most appropriate answer from the options given . | |  |
|  | **Assertion (A):** Induced emf in two coils made of wire of the same length and the same thickness, one of copper and another of aluminium is same. The current in copper coil is more than the aluminium coil.  **Reason (R):** Resistance of aluminium coil is more than that of copper coil. | | 1 |
|  | a) Both Assertion (A) and Reason (R) are true and Reason (R) is the correct explanation of Assertion (A). | b) Both Assertion (A) and Reason (R) are true, but Reason (R) is not the correct explanation of Assertion (A). |  |
|  | c) Assertion (A) is true, but Reason (R) is false. | d) Assertion (A) is false, but Reason (R) is true. |  |
|  | **Assertion (A):** In a series LCR circuit connected to an ac source, resonance can take place.  **Reason (R):** At resonance XL = XC. | | 1 |
|  | a) Both Assertion (A) and Reason (R) are true and Reason (R) is the correct explanation of Assertion (A). | b) Both Assertion (A) and Reason (R) are true, but Reason (R) is not the correct explanation of Assertion (A). |  |
|  | c) Assertion (A) is true, but Reason (R) is false. | d) Assertion (A) is false, but Reason (R) is true. |  |
|  | **SECTION B** | |  |
| 11 | The susceptibility of a magnetic material is –2.6 × 105. Identify the type of magnetic material and state its two properties. | | 2 |
| 12 | State Gauss law in magnetism. How it is different from Gauss law in electrostatics and why ? | | 2 |
| 13 | A conductor of length ‘*l’* is rotated about one of its ends at a constant angular speed 'ω' in a plane perpendicular to a uniform magnetic field B. Plot graphs to show variations of the emf induced across the ends of the conductor with (i) angular speed ω and (ii) length of the conductor *l*.​ | | 2 |
| 14 | Answer the following questions:-   1. In an a.c. circuit the voltage applied is E=E0 ​ sinωt. The resulting current in the circuit is I=I0 ​ sin(ωt−2π​). What is the average power consumed in one cycle in this circuit ? Why? | | 2 |
|  | 1. The current vs. frequency plots of two circuits having the same inductance and capacitance, but different resistance is shown above. Which of the two circuits will have a higher resistance? Why? |  |  |
| 15 | A small illuminated bulb is at the bottom of a tank, containing a liquid of refractive index ‘μ’ upto a height H. Find the expression for the diameter of an opaque disc, floating symmetrically on the liquid surface in order to cut- off the light from the bulb.  **OR**  Draw a ray diagram showing the formation of a real image of an object placed at a distance ‘u’ in front of a concave mirror of radius ‘R’ .Hence obtain the relation for the image distance ‘v’ in terms of u and R. | | 2 |
| 16 | Using Bohr’s postulates , obtain the texpression for radius of nth stable orbit in a hydrogen atom. | | 2 |
|  | **SECTION C** | |  |
| 17 | A series LCR circuit with R = 20 Ω , L = 2 H and C = 50 F is connected to a 200 volts ac source of variable frequency. What is (i) the amplitude of the current, and (ii) the average power transferred to the circuit in one complete cycle, at resonance ? (iii) Calculate the potential drop across the capacitor.  **OR**  An ac source v = vm sinω t is connected across an ideal capacitor. Derive the expression for the (i) current flowing in the circuit, and (ii) reactance of the capacitor. Plot a graph of current i versus ωt. | | 3 |
| 18 | Answer the following questions   1. Draw a sketch of a plane electromagnetic wave propagating along the z-direction. Clearly depict the directions of electric and magnetic fields varying sinusoidally with z. 2. How is displacement current different from conduction current? 3. Why infra red waves are called heat waves ? | | 3 |
| 19 | Draw a ray diagram to show how the final image is formed at infinity in an astronomical refracting telescope. Obtain an expression for its magnifying power.  Why is a reflecting telescope preferred over a refracting telescope ? Justify your answer giving one reason. | | 3 |
| 20 | A converging lens made of glass (*μ*=1⋅5) has its spherical faces of radii of curvature 10 cm and 20 cm. Find its focal length   1. in air, and 2. when it is immersed in a liquid of refractive index 1⋅25. | | 3 |
| 21 | 1. Differntiate between distnace of closest approach and impact paprameter  Determine the distance of the closest approach when an alpha particle of kinetic energy 4.5MeV strikes a nucleus of Z=80, stops, and reverses its direction. | | 3 |
| 22 | Draw a diagram to show the variation of binding energy per nucleon with mass number for different nuclei and mention its two features. Why do lighter nuclei usually undergo nuclear fusion ? | | 3 |
|  | **SECTION D** | |  |
| 23 | 1. The figure shows the variation of induced emf as a function of rate of change of current for two identical solenoids X and Y. One is air cored and the other is iron cored. Which one of them is iron cored ? Why ?      1. Derive an expression for the mutual inductance of two long coaxial solenoids of same length wound one over the other. 2. A long solenoid with 15 turns per cm has a small loop of area 2.0 cm2 placed inside the solenoid normal to its axis. If the current carried by the solenoid changes steadily from 2.0 A to 4.0 A in 0.1 s, what is the induced emf in the loop while the current is changing?   **OR**   1. State the principle behind the working of an ac generator. Briefly describe its working and obtain the expression for the instantaneous value of emf induced . 2. The magnetic field through a single loop of wire,12 cm in radius and 8.5Ω resistance, changes with time as shown in the figure. The magnetic field is perpendicular to the plane of the loop plot induced current as a function of time. | | 5 |
| 24 | 1. A spherical surface of radius of curvature R separates two media of refractive indices n1 and n2. A point object is placed in front of the surface at distance u in medium of refractive index n1 and its image is formed by the surface at distance v, in the medium of refractive index n2. Derive a relation between u and v. 2. A ray PQ incident on the face AB of a prism ABC, as shown in the figure, emerges from the face AC such that AQ = AR.   Draw the ray diagram showing the passage of the ray through the prism. If the angle of the prism is 600 and refractive index of the material of the prism is √3 , determine the values of angle of incidence and angle of deviation    **OR**   1. Draw a ray diagram showing refraction of a ray of light through a triangular glass prism. Hence, obtain the relation for the refractive index ( n ) in terms of angle of prism (A) and angle of minimum deviation (δm). 2. A ray of light PQ enters an isosceles right angled prism ABC of refractive index 1.5 as shown in figure.      1. Trace the path of the ray through the prism 2. What will be the effect on the path of the ray if the refractive index of the prism is 1.4 ? | | 5 |

\*\*\*