	SPECTRA CLASSES **CLASS: XII** **SUBJECT: PHYSICS** **M.M. 70** **TIME: 3 HRS**	
	General Instructions: (1) All questions are compulsory. There are 33 questions in all. (2) This question paper has five sections: Section A, Section B, Section C, Section Dand Section E. (3) Section A contains ten very short answer questions and four assertion reasoning MCQs of 1 mark each, Section B has two case-based questions of 4 marks each, Section C contains nine short answer questions of 2 marks each, Section D contains five short answer questions of 3 marks each and Section E contains three long answer questions of 5 marks each. (4) There is no overall choice. However internal choice is provided. You must attempt only one of the choices in such questions.	
	Section – A	
Q1	Electric field lines provide information about: (a) field strength (b) direction (c) nature of charge (d) all of these	1
Q2	In a Wheatstone bridge if the battery and galvanometer are interchanged then the deflection in galvanometer will : (a) change in previous direction (b) not change (c) change in opposite direction (d) none of these.	1
Q3	What is the value of the angle of dip at the magnetic equator? (a) 45 degree (b) 0 degree (c) 90 degree (d) 60 degree	1
Q4	In a pure capacitive circuit if the frequency of ac source is doubled, then its capacitive reactance will be: (a) remains same (b) doubled (c) halved (d) zero	1
Q5	The S.I. unit of capacitance is: (a) J/C (b) Farad (c) J^2/C (d) C/J	1
Q6	The magnetic flux linked with the coil (in weber) is given by the equation: $\left(\phi = 5t^2 + 3t + 16\right)$ The induced EMF in the coil at time, t=4 will be: (a) -27 V (b) -43 V (c) – 108 V (d) 210 V	1
Q7	A circular coil of 25 turns and radius 12 cm is placed in a uniform magnetic field of 0.5 T normal to the plane of the coil. If the current in the coil is 6 A, then total torque acting on the coil is:	1

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	(a) zero (b) 3.4 N-m (c) 3.8 N-m (d) 4.4 N-m	
Q8	A rectangular loop of side 6cm and 2cm with a small cut is moving out of a region of uniform magnetic field of magnitude 0.4 T directed normal to the loop. The voltage developed across the cut if velocity of loop is 2cm s^{-1} in a direction normal to the longer side is: (a) 3.8×10^{-4} V (b) 4.8×10^{-4} V (c) 2.2×10^{-2} V (d) 3.2×10^{-2} V	1
Q9	In single slit diffraction pattern: (a) central fringe has negligible width than others (b) All fringes are of same width (c) central fringes do not exist (d) None of the above	1
Q10	Which spectral series of hydrogen lie in UV region? (a)Paschen series (b) Lyman series(c) Brackett series (d) Balmer series	1
	For question numbers 11, 12, 13 and 14, two statements are given-one labelled Assertion (A) and the other labelled Reason (R). Select the correct answer to these questions from the codes (a), (b), (c) and (d) as given below. **a) Both A and R are true and R is the correct explanation of A.** **b) Both A and R are true but R is NOT the correct explanation of A.** **c) A is true but R is false.** **d) A is false and R is also false.**	
Q11	**Assertion(A):** Gauss's law of magnetism is different from that for electrostatics. **Reason(R):** Isolated magnetic poles are not known to exist.	1
Q12	**Assertion(A):** Magnetic charge Interacts with the moving charge and not with a stationary charge. **Reason(R):** A moving charge produces a magnetic field	1
Q13	**Assertion (A):** If optical density of a substance is more than that of water then the mass density of a substance can be less than water. **Reason(R):** Optical density and mass density are not related.	1
Q14	**Assertion(A):** The resistivity of a semiconductor increases with temperature. **Reason (R):** The atoms of a semiconductor vibrate with larger amplitudes at higher temperatures thereby increasing its resistivity.	1
	Section – B	
	Questions 15 and 16 are Case Study based questions and are compulsory. Attempt any 4 sub parts from each question. Each question carries 1 mark.	

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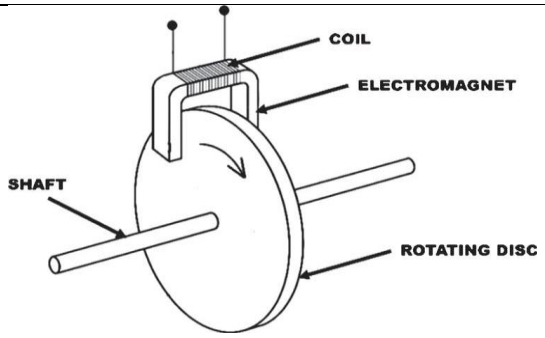
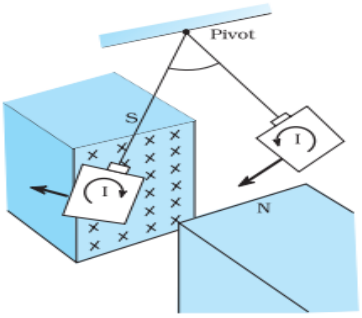
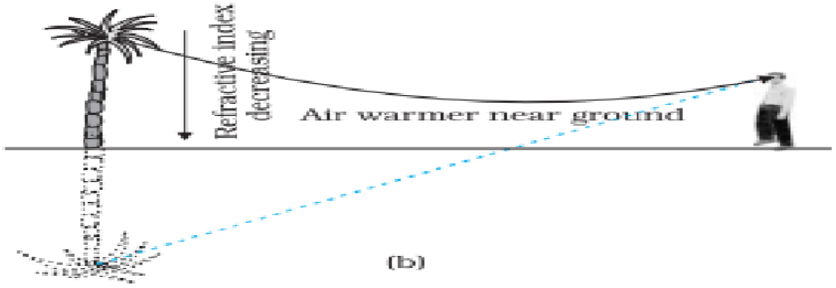
Q15	  (a) (b)	4
	i. Which phenomenon/ effect is shown in the above figures: a) Eddy current b) Dark current c) LC Oscillator d) Oersted's observation ii. The above phenomenon finds application in a) Accelerating electrons b) Nuclear fission c) Electric power meters d) Cyclotron iii. One of the applications of the above phenomenon is shown in above figure (a). It is a) Electromagnetic damping b) Magnetic breaking in trains c) Induction furnace d) None of the above iv. In the above figure (b) the oscillating metal strips will a) Oscillate without loss of energy b) Will lose kinetic energy and stop c) Will gain energy d) Will stick to the bar magnets v. To avoid occurrence of the above effect/phenomenon a) Slots are cut in metal pieces which will oscillate in magnetic field b) They are provided with more kinetic energy to compensate for loss in energy c) stronger magnetic fields are avoided d) none of the above	
Q16	which phenomenon is shown in the below figure: a)  (b) refraction of light b) reflection of light c)total internal reflection d) scattering of light ii. For phenomenon shown above to occur	4

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	a) ray of light must pass through rarer medium to denser medium b) ray of light must pass through denser to rarer medium c) there must be no change in medium of light d) none of the above iii. The phenomenon occurs generally and observed a) during winters in open fields b) hot summer days in deserts c) rainy season d) during night at poles iv. In the above phenomenon, angle of incidence and angle of refraction a) are equal b) angle of incidence is greater than angle of refraction c) angle of incidence is smaller than angle of refraction d) none of the above v. The application of above phenomenon is in a) transmission of highspeed data b) formation of real image c) to obtain coherent light d) all of the above	
	Section – C	
Q17	A proton and an alpha particle of the same velocity enter in turn a region of uniform magnetic field, acting perpendicular to their direction of motion. Deduce the ratio of the radii of circular paths describe by them.	2
Q18	Draw the diagrams to show the behaviour of plane wave fronts as they pass through: (a) thin prism (B) thin convex lens OR State two conditions for sustained Interference.	2
Q19	Prove that two identical cells each of emf E, internal resistance r will send same current in an external resistance R whether all cells are connected in series or in parallel, if R=r	2
Q20	With the help of a suitable diagram, explain the formation of depletion region in a p-n junction. How does its width change when the junction is: (i) forward biased (ii) reverse biased	2

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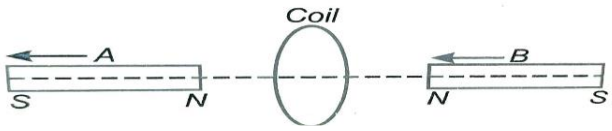
Q21	In the figure A and B are identical magnets. Magnet A is moved away from the coil with a given speed. Magnet B is moved towards the coil with the same speed. What is the induced emf in the coil?  OR Define Mutual Inductance. How does the Mutual Inductance between two coils be affected when: (I) Separation between the coils increases. (II) Number of turns increases.	2
Q22	How the angular separation of interference fringes in Young's double slit experiment change when the distance between the slits and screen is halved?	2
Q23	Differentiate conductors and semiconductors on the basis of energy band diagrams.	2
Q24	Define angle of dip and angle of declination of a magnetic compass OR Derive an expression for magnetic field intensity due to circular loop at its centre.	2
Q25	What are the merits of reflecting telescope over the refracting telescope? Draw a ray diagram to show image formation for a (Cassegrain) reflecting telescope. What is the magnifying power?	2
	SECTION- D	
Q26	A rod of length L is moved horizontally with a uniform velocity v in a direction perpendicular to its length through a region in which a uniform magnetic field is acting vertically downward. Derive the expression for the emf induced across ends of the rod. If the resistance of the rod is R, then also find the expression for the current induced.	3

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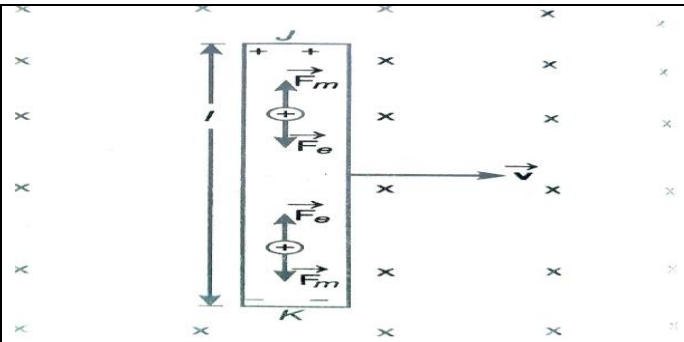
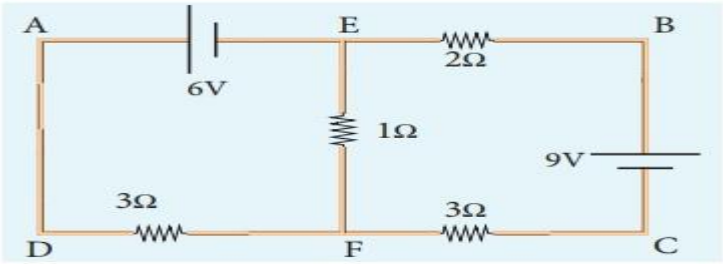
		
Q27	Calculate the current that flows in the 1 Ω resistor in the following circuit.  OR A battery has an emf E and internal resistance r. A variable resistance R is connected across the terminals of the battery. Find the value of R such that a. The current is maximum b. The potential difference across the terminals is maximum c. Plot the graph between V and R	3
Q28	Draw a graph showing the variation of stopping potential with the frequency of incident radiation in relation to photoelectric effect. a. What does the slope of this graph represent? b. How can the value of Planck's constant be determined from this graph?	3
Q29	Draw a schematic arrangement of the Geiger-Marsden experiment. How did the scattering of alpha particles on a thin foil of gold provide an important way to determine the upper limit on the size of the nucleus? Explain briefly	3
Q30	Show that Bohr's second postulate, the electron revolves around the nucleus only in a certain fixed orbit without radiating energy' can be explained on the basis of de-Broglie hypothesis of wave nature of electron. OR	3

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	State Bohr's Postulates. Using it find Out an Expression for Energy of electron in nth orbit for H atom.	
	SECTION- E	
Q31	(a) Define resistivity and explain how the resistivity of a conductor depends upon the temperature? (b) Derive the condition for the balanced Wheatstone bridge. How this is utilised in meter bridge to determine the resistivity of the material of the wire. OR (a) Define an ideal electric dipole. Give an example. (b) An electric dipole of length 2cm is placed with its axis making an angle of 60^0 with respect to uniform electric field of 10^5 N/C. If it experiences a torque of $8\sqrt{3}$ Nm, calculate the magnitude of charge on the dipole, and its potential energy.	5
Q32	(i) Derive an expression for torque on a current carrying loop in a magnetic field. Name the device that works on this concept. For what orientation of the coil is this torque (a) maximum and (b) minimum? Hence define magnetic dipole moment of the coil. (ii) Two wires of equal lengths are bent into the form of two loops. One of the loops is square shaped whereas the other loop is circular. These are suspended in a uniform magnetic field and the same current is passed through them. Which loop will experience greater torque? Justify your answer. OR (i) On a smooth plane inclined at 30^0 with the horizontal, a thin current carrying metallic rod is placed parallel to the horizontal ground. The plane is in a uniform magnetic field of 0.15 T in the vertical direction. For what value of current can the rod remain stationary? The mass per unit length of rod is 0.03 kg/m. (ii) A long wire carries a steady current I. It is at first bent into a circular loop and magnetic field at its centre is found to be B_0. Then the same wire is bent into a circular coil of n turns. Find the magnetic field at the centre point now.	5

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Q33	A ray of light goes from medium 1 to medium 2. Velocity of light in the two media are c_1 and c_2, respectively. For an angle of incidence, θ in medium 1. The corresponding angle of refraction in medium 2 is θ/2. (a) Which of the two media is optically denser and why? (b) Establish the relationship among θ, c_1 and c_2. (c) The critical angle of incidence in a glass slab placed in air is 45^0. What will be the critical angle when it is immersed in water of refractive index 1.33? OR State Huygen's principle. Using this principle, draw a diagram to show how a plane wavefront incident at the interface of two media gets refracted when it propagates from a rarer to a denser medium. Hence, verify Snell's law of refraction. Is the frequency of reflected and refracted light same as the frequency of incident light?	5

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