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Kendriya Vidyalaya Sangathan (Jammu Region)

Subject : Physics Theory (042) **Class : 12**

Time : 3 hours **Max. Marks: 70**

General Instructions:

1) All questions are compulsory. There are 33 questions in all.
2) This question paper has five sections: Section A, B, C, D and E.
3)

Section	No. of questions	Marks	Total
A	14	1 Marks each	14
B	2	4 Marks each	08
C	9	2 Marks each	18
D	5	3 Marks each	15
E	3	5 Marks each	15
Total			70

4) There is no overall choice. However internal choice is provided. You have to attempt only one of the choices in such questions.

S. No.	Question	Marks
	Section – A **All questions are compulsory. In case of internal choice, attempt any one of them.**	
1	Name the physical quantity having unit weber/m^2.	1
2	Mention one use of part of electromagnetic spectrum to which a wavelength of 300 nm belongs. OR Write the SI unit of the ratio of Electric field to that of Magnetic field.	1
3	What is the amount of work done by the magnetic field? Write the reason also.	1
4	Write any two factors on which inductance of an inductor depend? OR An alternating current from a source is given by i=10sin314t. What is the rms value and peak value of current?	1
5	To which region of the spectrum does the spectral lines of Balmer series belongs?	1
6	If electron and proton have same kinetic energy, which one will have more de-Broglie wavelength?	1
7	In number of unstable nuclei in a radioactive substance become 25% in 64 days. Find its half-life. OR Define binding energy.	1
8	Draw the energy band diagram of p type semiconductor? OR In full wave rectification, what is the output frequency if input frequency is 50 Hz.	1 1
9	Write any two changes that takes place when a diode is in reverse biasing?	1
10	Draw the symbol of Diode which emits photons? Under which biasing is it used?	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.	

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	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**	
11	Assertion (A): In a uniform electric field, a dipole will have only rotatory motion. Reason (R): In a uniform electric field, a dipole experiences only torque as net force is zero.	1
12	Assertion (A): Electric field is always perpendicular to equipotential surfaces and along the direction of decreasing order of potential Reason (R): SI unit of electric field is V/m.	1
13	Assertion (A): A convex mirror always forms virtual images. Reason (R): Concave lens diverges the parallel rays that are incident on it.	1
14	Assertion (A): A pencil placed in a beaker filled with water appears to be tilted/ bent. Reason (R): a ray of light coming from denser medium to rarer medium bends away from the normal.	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.**	
15	 The Van De Graff Generator is basically an electrostatic machine that can generate high voltages. A typical Van De Graff Generator consists of an insulating belt that transports electrical charge to a terminal. The charges that are sent on the belt are generated through a high voltage DC supply. These charges are collected in the inside of the terminal and transferred to its external surface. The first Van de Graff Generator was invented by Dr. Robert J Van De Graff in 1931 in the Unites States of America (USA) for the sole purpose of generating and using high voltages for use in nuclear physics experiments. The Van De Graff generator works simply on the principle of static electricity. All matter, as we know is made up of atoms which further constituted of electrons, neutrons and protons. Electrons carry negative charge whereas protons are considered to be positively charged. When the number of electrons and protons remain the same, the matter is considered to be neutral in charge. A negatively charged matter has more number of electrons than protons while the opposite holds true for a positively charged matter. Electrons can flow from one matter to another. Primarily designed as a particle accelerator, the Van De Graff generators are used in laboratories for demonstration purposes only. However, it must be noted that Van de Graff generators were one of the first methods used to study nuclear physics before the advent of better methods to accelerate particles. 1. Van de Graff generator is a device that can generate: a) High current b) High potential c) Low potential d) High magnetic field	1

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	2. Electrons flow from a) High potential to low potential b) Low potential to high potential c) Does not depend on potential difference d) None of the above	1
	3. A body can become negatively charged by: a) Gain of electron b) Loss of electron c) Both a and b d) None of the above	1
	4. Observe the lady shown above, why her hairs are spreading outwards? a) Because of current b) She is charged and it is positive charge c) She is charged and it is negative charge d) She is charged but of the same nature can be positive and negative	1
16	The basic medium of fibre optics is a hair-thin fibre that is sometimes made of <u>plastic</u> but most often of <u>glass</u>. A typical glass optical fibre has a diameter of 125 micrometres (μm), or 0.125 mm (0.005 inch). This is actually the diameter of the cladding, or outer reflecting layer. The core, or inner transmitting cylinder, may have a diameter as small as 10 <u>μm</u>. Through a process known as <u>total internal reflection</u>, <u>light</u> rays beamed into the fibre can <u>propagate</u> within the core for great distances with remarkably little attenuation, or reduction in intensity. The degree of attenuation over distance varies according to the wavelength of the light and to the <u>composition</u> of the fibre.  	
	1. Out of core and cladding which is denser? a) Core b) Cladding c) Both are equally dense d) None of the above	1
	2. Which of the following is one of the conditions of total internal reflection? a) Light must travel from rarer to denser medium b) Angle of incidence should be less than critical angle c) Angle of incidence should be greater than critical angle d) None of the above	1
	3. Critical angle is the angle of incidence for which angle of refraction is: a) 90^0 b) Less than 90^0 c) More than 90^0 d) None of the above	1
	4. Total internal reflection is used in : a) MRI b) C T scan c) Endoscopy d) microscopy	1
	Section – C **All questions are compulsory. In case of internal choices, attempt anyone.**	

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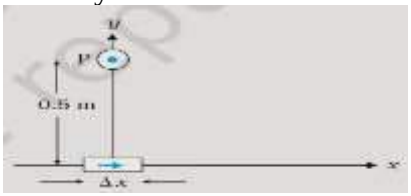
17	An element $\Delta\mathbf{l} = \Delta\mathbf{x}\ \mathbf{i}$ is placed at the origin and carries a large current i = 10 A. What is the magnetic field on the y-axis at a distance of 0.5 m. Δx = 1 cm. 	2
18	In Young's double-slit experiment using monochromatic light of wavelength λ , the intensity of light at a point on the screen where path difference is λ , is K units. What is the intensity of light at a point where path difference is λ /3? OR Draw the shape of the wavefront in each of the following cases: (a) Light diverging from a point source. (b) Light emerging out of a convex lens when a point source is placed at its focus.	2
19	Derive the expression of potential due to a short dipole at any arbitrary point. OR What do you understand by equipotential surface? What is the net work done when a charge is moved along an equipotential surface and why?	2 1 ½ + ½
20	Explain with help of circuit diagram, the working of a special p-n junction diode which detects the light. Name it.	2
21	A long solenoid with 15 turns per cm has a small loop of area 2.0 cm^2 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?	2
22	In a Young's double-slit experiment, the slits are separated by 0.28 mm and the screen is placed 1.4 m away. The distance between the central bright fringe and the fourth bright fringe is measured to be 1.2 cm. Determine the wavelength of light used in the experiment	2
23	Differentiate between p type and n type semiconductor.	2
24	Define the terms magnetic meridian and geographic meridian. OR Vertical component of earth's magnetic field at a place is √3 times the horizontal component. What is the value of angle of dip at that place?	2 2
25	Draw the ray diagram of astronomical telescope in normal adjustment.	2
	Section -D **All questions are compulsory. In case of internal choices, attempt any one.**	
26	A conducting circular loop is placed in a uniform magnetic field B = 0.020T with its plane perpendicular to the field. Somehow, the radius of the loop starts shrinking at a constant rate of 1mm/s. Find the induced current in the loop at an instant when the radius is 2cm.	3
27	Write the principle and working of an ideal voltmeter. Name it. How can the sensitivity of this instrument be increased? OR Derive the expression of equivalent emf of two cells (e1, r1) and (e2, r2) connected in parallel. Where e is emf and r is internal resistance of the cells.	3
28	The work function of caesium metal is 2.14 eV. When light of frequency 6×10^{14}Hz is incident on the metal surface, photoemission of electrons occurs. What is the (a) maximum kinetic energy of the emitted electrons, (b) Stopping potential, and (c) Maximum speed of the emitted photoelectrons?	3

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	OR Write three properties of photons. Why wave theory of light could not explain the photoelectric effect?	
29	A hydrogen atom initially in the ground level absorbs a photon, which excites it to the n = 4 level. Determine the wavelength and frequency of photon.	3
30	a) With the help of Binding energy per nucleon curve explain why it is low for lighter and very heavy nuclei and high for middle weighted nuclei. b) With the help of law of radioactive decay obtain the expression of half-life.	3
	Section – E **All questions are compulsory. In case of internal choices, attempt any one.**	
31	Net capacitance of three identical capacitors in series is 1μf. What will be their net capacitance if connected in parallel? Find the ratio of energy stored in the two configurations, if they are both connected to the same source. State Gauss's law and use this law to derive the electric filed at a point from an infinitely long straight uniformly charged wire. Or a) How does the balancing point of a Wheatstone bridge get affected i) Position of cell and Galvanometer are interchanged? ii) Position of the known and unknown resistances is interchanged? b) Using Kirchhoff's rules obtain the condition of balanced Wheatstone bridge.	5
32	In series LCR circuit with L= 3H, C= 27μF and R= 30 Ω. at resonance, Explain the following: a) Write the expression is the frequency at resonance? b) What is impedence at resonance? c) Is the current maximum or minimum? d) Find quality factor? How will it change if resistance increases? OR a) State the principle of transformer. b) Explain with the help of a well labelled diagram, its working and explain why number of turns in secondary coils is the deciding factor of increase or decrease in voltage/ current. c) Why AC is preferred over DC for power transmission over long distances.	5
33	a) State Huygen's wave principle. b) On the basis of Huygen's wave principle explain how central maxima is obtained even though there is only one source OR a) Derive the lens maker formula. b) Three narrow beam of light namely red, green and blue incident on convex lens explain which beam of light will be focussed first and why?	5

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Marking Scheme

Subject : Physics Theory (042) **Class : 12**

S. No.	VALUE POINTS	MARKS
1	Magnetic field	1
2	Any one use of U-V radiation. Or m/s	1 1
3	Zero Reason	½ ½
4	Any two factors Or rms value and peak value	½ + ½ ½ + ½
5	visible	1
6	electron	1
7	32 days Or Definition	1 1
8	Correct energy band diagram Or 100 Hz	1 1
9	Any two changes	½ + ½
10	LED, forward biasing	½ + ½
11	**a) Both A and R are true and R is the correct explanation of A**	1
12	**b) Both A and R are true but R is NOT the correct explanation of A**	1
13	**b) Both A and R are true but R is NOT the correct explanation of A**	1
14	**a) Both A and R are true and R is the correct explanation of A**	1
15	1) B 2) B 3) A 4) D	1 1 1 1
16	1) A 2) C 3) A 4) C	1 1 1 1
17	Formula Substitution of values Solution Direction	½ ½ ½ ½
18	Expression of intensity Solution Or Correct wavefront diagrams	1 1 1+1
19	Diagram Derivation Or Definition Zero Correct Reason	½ 1 ½ 1 ½ ½
20	Diagram Working Name : photodiode	1 ½ ½
21	Conversion of given quantities into SI units Correct Formula used and substitution	½ ½ + ½

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	Solution	½
22	Conversion of given quantities into SI units Correct Formula used and substitution Solution	½ ½ + ½ ½
23	Any two differences	1+1
24	Definition of the terms Or Formula Substitution and solution	1+1 1 ½ + ½
25	Correct diagram	2
26	$\Phi = \Pi r^2 B$ $d\Phi/dt = 2\Pi rB\ dr/dt$ $e = 25\mu V$	1 1 1
27	Name: Potentiometer Principle Working Sensitivity can be increased by (any method) Or Diagram Derivation Correct expression	½ 1 1 ½ ½ 2 ½
28	a) Maximum Kinetic energy b) Stopping potential c) Maximum speed Or Three properties of photons (any three) Correct explanation	1 1 1 3* ½ 1 ½
29	Correct formula for frequency and wavelength	½+ ½
	Calculation of frequency	1
	Calculation of wavelength	1
30	Correct explanation	1 ½
	Derivation of half-life	1 ½
31	9μf 1 : 9 Statement Derivation Or No change in balanced length Balanced length will become 100-*l* Circuit diagram Derivation	1 1 1 2 1 1 1 2
32	Correct expression of frequency Impedence is equal to resistance 30 ohm Current is maximum Formula of q factor Calculation Q factor decreases as resistance increases Or Principle Diagram Working Explanation of effect of number of turns Reason of preference of AC over DC	1 1 1 1 ½ ½ 1 1 1 1 1
33	Statement of Huygen's wave principle Explanation of single slit diffraction experiment Or	2 3

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	Derivation Blue Correct Reason	3 1 1