

**SPECIAL QUESTION PAPER – 2016**

Class: XII<sup>th</sup>STD

Subject: **PHYSICS**

Marks: 150 Time: 3 hrs.

**PART - I (30x1=30)**

**(i) Answer all the questions. (ii) Choose and write the correct answer.**

1. An infinite line charge produces a field of  $9 \times 10^4 \text{ NC}^{-1}$  at a distance of 2 cm. Calculate the linear charge density ( $\lambda$ )  
(a)  $10^{-7} \text{ Cm}^{-1}$  (b)  $10^{-8} \text{ Cm}^{-1}$  (c)  $10^{-9} \text{ Cm}^{-1}$  (d)  $10^{-11} \text{ Cm}^{-1}$
2. A dipole is placed in a uniform electric field with its axis parallel to the field. It experiences  
(a) Only a net force (b) only a torque (c) both a net force and torque (d) neither a net force nor a torque
3. Three capacitors each of capacitors 9 pF are connected in series. What is the total capacitance of the combination  
(a) 3pF (b) 4 pF (c) 5pF (d) 6pF
4. Electric potential energy (U) of two point charges is  
(a)  $\frac{q_1q_2}{4\pi\epsilon_0r^2}$  (b)  $\frac{q_1q_2}{4\pi\epsilon_0r}$  (c)  $pE\cos\theta$  (d)  $pE\sin\theta$
5. A toaster operating at 240V has a resistance of  $120\Omega$ . The power is  
(a) 400 W (b) 2 W (c) 480 W (d) 240 W
6. In thermocouple, the temperature of the cold junction is  $20^\circ\text{C}$ , the neutral temperature is  $270^\circ\text{C}$ . The temperature of inversion is  
(a)  $520^\circ\text{C}$  (b)  $540^\circ\text{C}$  (c)  $500^\circ\text{C}$  (d)  $510^\circ\text{C}$
7. A conductor of length 50 cm carrying a current of 5A is placed perpendicular to a magnetic field of induction  $2 \times 10^{-3} \text{ T}$ . Find on force (F) on the conductor  
(a)  $5 \times 10^{-3} \text{ N}$  (b)  $5 \times 10^{-4} \text{ N}$  (c)  $5 \times 10^{-5} \text{ N}$  (d)  $5 \times 10^{-6} \text{ N}$
8. The Self-inductance of a straight conductor is  
(a) zero (b) infinity (c) very large (d) very small
9. Electromagnetic induction is not used in  
(a) transformer (b) room heater (c) AC generator (d) choke coil
10. In LCR circuit when  $X_L = X_C$  (at resonance) the current  
(a) is zero (b) is in phase with the voltage (c) leads the voltage (d) lags behind the voltage
11. A power of 11,000 W is transmitted at 220 V. The current through line wire is  
(a) 50 A (b) 5 A (c) 500 A (d) 0.5 A

12. If the wavelength of the light is reduced to one fourth, then the amount of scattering is (a) increased by 16 times (b) decreased by 16 times (c) increased by 256 times (d) decreased by 256 times
13. When a drop of water is introduced between the glass plate and plano convex lens in Newton's rings system, the ring system (a) contracts (b) expands (c) remains same (d) first expands, then contracts
14. The transverse nature of light is demonstrated only by the phenomenon of (a) interference (b) diffraction (c) polarization (d) refraction
15. The refractive index of glass is 1.5. The velocity of light in glass is (a)  $2 \times 10^8 \text{ ms}^{-1}$  (b)  $4.5 \times 10^8 \text{ ms}^{-1}$  (c)  $3 \times 10^8 \text{ ms}^{-1}$  (d)  $1.33 \times 10^8 \text{ ms}^{-1}$
16. The first excitation potential energy or the minimum energy required to excite the atom from ground state of hydrogen atom is (a) 13.6 eV (b) 10.2 eV (c) 3.4 eV (d) 1.89 eV
17. A Coolidge tube operates at 24800 V. The maximum frequency of X-radiation emitted from Coolidge tube is (a)  $6 \times 10^{18} \text{ Hz}$  (b)  $3 \times 10^{18} \text{ Hz}$  (c)  $6 \times 10^8 \text{ Hz}$  (d)  $3 \times 10^8 \text{ Hz}$
18. In hydrogen atom, which of the following transitions produce a spectral line of maximum wavelength (a)  $2 \rightarrow 1$  (b)  $4 \rightarrow 1$  (c)  $6 \rightarrow 5$  (d)  $5 \rightarrow 2$
19. The minimum wavelength of X-rays produced in an X-ray tube at 1000 kV is (a)  $0.0124 \text{ \AA}$  (b)  $0.124 \text{ \AA}$  (c)  $1.24 \text{ \AA}$  (d)  $0.00124 \text{ \AA}$
20. At the threshold frequency, the velocity of the electrons is (a) Zero (b) maximum (c) minimum (d) infinite
21. Electron microscope works on the principle of (a) Photoelectron effect (b) particle nature of electron (c) wave nature of moving electron (d) dual nature of matter
22. The explosion of atom bomb is based on the principle of (a) Uncontrolled fission reaction (b) controlled fission reaction (c) fusion reaction (d) thermonuclear reaction
23. The time taken by the radioactive element to reduce to  $1/e$  times is (a) Half life (b) mean life (c) half life / 2 (d) twice the mean life
24. Which of the following are isotones (a)  ${}_{92}\text{U}^{235}$  and  ${}_{92}\text{U}^{238}$  (b)  ${}_{8}\text{O}^{16}$  and  ${}_{7}\text{N}^{14}$  (c)  ${}_{6}\text{C}^{14}$  and  ${}_{7}\text{X}^{14}$  (d)  ${}_{7}\text{N}^{14}$  and  ${}_{6}\text{C}^{13}$
25. Which of the following group is a baryon? (a) photon (b) electron (c) pion (d) proton

26. Avalanche breakdown is primarily dependent on the phenomenon of  
(a) collision (b) ionisation (c) doping (d) recombination
27. The forbidden energy gap for conductors is  
(a) 0.7 eV (b) 1.1 eV (c) zero (d) 3 eV
28. The Boolean expression  $\overline{ABC}$  can be simplified as  
(a)  $AB + \overline{C}$  (b)  $\overline{A} \cdot \overline{B} \cdot \overline{C}$  (c)  $AB + BC + CA$  (d)  $\overline{A} + \overline{B} + \overline{C}$
29. The audio frequency range is  
(a) 20 Hz to 200 Hz (b) 20 Hz to 2000 Hz (c) 20 Hz to 200,000 Hz (d) 20 Hz to 20,000 Hz
30. An FM signal has a resting frequency of 105 MHz and highest frequency of 105.03 MHz, when modulated by a signal. Then the carrier swing is  
(a) 0.03 MHz (b) 0.06 MHz (c) 0.03 KHz (d) 60 MHz

**PART- II**

**(15x3=45)**

**(i) Answer any fifteen questions.**

31. State coulomb's law in electrostatics and represent in vector form.
32. Mention applications of capacitors?
33. The resistance of a nichrome wire at  $0^\circ \text{C}$  is  $10 \Omega$ . If its temperature coefficient of resistance is  $0.004/^\circ\text{C}$ , find its resistance at boiling point of water. Common on the result.
34. State ohm's law.
35. Why automobile batteries have low internal resistance?
36. Define ampere.
37. State the methods of producing induced *emf*.
38. Magnetic field through a coil having 200 turns and cross sectional area  $0.04 \text{ m}^2$  changes from  $0.1 \text{ wb m}^{-2}$  to  $0.04 \text{ wb m}^{-2}$  in 0.02 s. find the induced *emf*.
39. Distinguish between Fresnel and Fraunhofer diffraction.
40. Give the conditions for sustained interference.
41. What are the conditions to achieve laser action.
42. Write any 3 properties of cathode rays.
43. State the postulates of special theory of relativity.
44. Define curie.
45. Mention any 3 properties of  $\alpha$ -rays.
46. Give the Barkhausen criteria for oscillations.
47. What is zener breakdown?
48. When the negative feedback is applied to an amplifier of gain 50, the gain after feedback falls to 25. Calculate the feedback ratio.

49. Construct a logic circuit using NAND gates only for  $Y = \bar{A} + \bar{B}C$   
50. What are the advantages of fiber optic communication system?

**PART – III**

**(7x5=35)**

- i) Answer question No. 52 is Compulsory. (ii) Answer any six questions of the remaining 11 questions. (iii) Draw diagrams wherever necessary.**

51. Prove that the energy stored in a parallel plate capacitor is  $\frac{q^2}{2C}$   
52. (a) Find the current flowing across three resistors  $3\Omega$ ,  $5\Omega$  and  $2\Omega$  connected in parallel to a 15 V supply. Also find the effective resistance and total current drawn from the supply.  
(b) In a metre bridge, the balancing length for a  $10\Omega$  resistance in left gap is 51.8 cm. Find the unknown resistance and specific resistance of a wire of length 108 cm and radius 0.2 mm.  
53. How can *emf* of two cells be compared using potentiometer?  
54. Explain how you will convert a galvanometer into an ammeter.  
55. Obtain expression for the current in an ac circuit containing resistor.  
56. Write a note on Nicol prism.  
57. Monochromatic X-ray wavelength  $1\text{\AA}$ , when falls on a crystal, successive reflections take place at angles  $30^\circ$  and  $45^\circ$  respectively. Find the lattice constant of the crystal.  
58. What are the applications of photo-cells?  
59. Derive Einstein's mass energy equivalence.  
60. Explain how carbon-nitrogen cycle can account for the production of stellar energy.  
61. State and prove DeMorgan's theorems.  
62. Explain the function of Am radio transmitter with neat block diagram?

**PART - IV**

**(4x10=40)**

- (i) Answer any four questions in detail. (ii) Draw diagrams whenever necessary.**

63. State Gauss's law. Applying this, calculate electric field due to (i) an infinitely long straight charge with uniform charge density. (ii) an infinite plane sheet of charge of  $q$   
64. Obtain an expression for the magnetic induction at a point due to an infinitely long straight conductor carrying current.  
65. Discuss with theory the method of inducing *emf* in a coil by changing its orientation with respect to the direction of the magnetic field.  
66. Derive an expression for bandwidth of interference fringes in Young's

double slit experiment.

67. With the help of energy level diagram, explain the working of He–Ne laser.
68. Explain the construction and working of a Geiger – Muller Counter.
69. Describe an operational amplifier. Explain its action as (i) inverting amplifier and (ii) non-inverting amplifier.
70. Explain the functional block diagram of a monochrome TV receiver.

**...ALL THE BEST...**

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