

No. of Printed Pages : 4

Register Number

--	--	--	--	--	--	--	--

A

PART – III, aw:gpai; / **PHYSICS**

(English Version)

Time Allowed : 3.00 Hours]

[Maximum Marks : 70

- Instructions :**
- (1) Check the question paper for fairness of printing. If there is any lack of fairness, inform the Hall Supervisor immediately.
 - (2) Use **Blue** or **Black** ink to write and underline and pencil to draw diagrams.

PART – I

- Note :**
- (i) Answer **all** the questions. **15x1=15**
 - (ii) Choose the most appropriate answer from the given **four** alternatives and write the option code and the corresponding answer.

1. Two identical conducting balls having positive charges q_1 and q_2 are separated by a centre to centre distance r . If they are made to touch each other and then separated to the same distance, the force between them will be :
 - (a) less than before
 - (b) same as before
 - (c) more than before
 - (d) zero
2. In an ac circuit voltage and current are given by $V = 50 \sin 50t$ Volt and $i = 100 \sin (50t) + \frac{\pi}{3}$ A. The power dissipated in the circuit will be:
 - (a) 2.5 kW
 - (b) 1.25 kW
 - (c) 5 kW
 - (d) 500 W
3. The nucleus is approximately spherical in shape. Then the volume of nucleus having mass number A varies as :
 - (a) A
 - (b) $A^{4/3}$
 - (c) $A^{1/3}$
 - (d) $A^{5/3}$
4. The wavelength λ_e of an electron and λ_p of a photon of same energy E are related by
 - (a) $\lambda_p \propto \lambda_e$
 - (b) $\lambda_p \propto \sqrt{\lambda_e}$
 - (c) $\lambda_p \propto \frac{1}{\sqrt{\lambda_e}}$
 - (d) $\lambda_p \propto \lambda_e^2$
5. The resistance of a uniform wire of length l and cross-sectional area A , is R . The resistance of wire of the same material having length $2l$ and cross-sectional area $2A$ is :
 - (a) R
 - (b) $2R$
 - (c) $\frac{R}{2}$
 - (d) $\frac{R}{4}$

[Turn Over

S2020

2

6. Two polaroid's P_1 and P_2 are placed with their optic axes perpendicular to each other. If an un-polarized light of intensity I_0 is incident on the first polaroid P_1 then the intensity of transmitted light through the second polaroid P_2 will be :
- (a) $\frac{I_0}{2}$ (b) $\frac{I_0}{4}$ (c) 0 (d) $\frac{I_0}{8}$
7. A parallel plate capacitor stores a charge Q at a voltage V . Suppose the area of the parallel plate capacitor and the distance between the plates are each doubled then which is the quantity that will change?
- (a) capacitance (b) Charge (c) Voltage (d) Energy density
8. The value of Bohr magneton μ_B is :
- (a) $9.27 \times 10^{-24} \text{ Am}$ (b) $9.27 \times 10^{24} \text{ Am}^{-1}$
(c) $9.27 \times 10^{24} \text{ Am}^{-2}$ (d) $9.27 \times 10^{-24} \text{ Am}^2$
9. The variation of frequency of carrier wave with respect to the amplitude of the modulating signal is called:
- (a) amplitude modulation (b) phase modulation
(c) frequency modulation (d) pulse width modulation
10. A system consists of N_0 nucleus at $t = 0$. The number of nuclei remaining after half of half-life (that is, at time $t = \frac{1}{2} T_{1/2}$)
- (a) $\frac{N_0}{2}$ (b) $\frac{N_0}{\sqrt{2}}$ (c) $\frac{N_0}{4}$ (d) $\frac{N_0}{8}$
11. When the current changes from 2 A to - 2 A in 0.05 s, an emf of 8 V is induced in a coil. The coefficient of self-induction of the coil is:
- (a) 0.2 H (b) 0.4 H (c) 0.8 H (d) 0.1 H
12. The average energy density of an electromagnetic wave is:
- (a) $\frac{1}{2} \epsilon_0 E$ (b) $\frac{1}{2} \epsilon_0 E^2$ (c) $\frac{1}{4} \epsilon_0 E^2$ (d) $\frac{1}{4} \epsilon_0 E$
13. The threshold wavelength for a metal surface whose photoelectric work function is 3.313 eV is :
- (a) 4125 Å (b) 37350 Å (c) 6000 Å (d) 2062.5 Å
14. The dopant to be added with a pure Germanium Crystal to form n type semiconductor is:
- (a) Boron (b) Phosphorus (c) Aluminium (d) Indium
15. If a beam of un-polarized light is incident on a reflecting glass surface at an angle of 57.5° , then the angle between the reflected and refracted beam will be :
- (a) 45° (b) 60° (c) 90° (d) 30°

PART – II

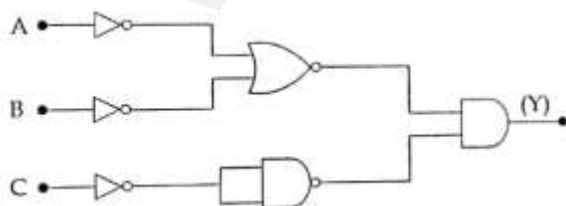
Note : Answer **any six** questions. Question No. **24** is **compulsory.** **6x2=12**

16. Define skip distance.
17. Calculate the cut-off wavelength and cut-off frequency of X-rays from an X-ray tube of accelerating potential 20,000 V.
18. State Lenz's law.
19. Potential in a given region is given as a function of distance x , $V=5(x^2+x)$ Volt. Find the electric field when $x = 1$ cm.
20. What is Photovoltaic cell?
21. What are paraxial rays and marginal rays?
22. What are the constituent particles of Neutron and Proton?
23. What are the uses of X-rays?
24. If an electric field of magnitude 570 NC^{-1} . Is applied in the copper wire, find the acceleration experienced by the electron.

PART – III

Note : Answer **any six** questions. Question No. **33** is **compulsory.** **6x3=18**

25. Half lives of two radioactive elements A and B are 20 minutes and 40 minutes respectively. Initially the samples have equal number of nuclei. Calculate the ratio of decayed number of A and B nuclei after 80 minutes.
26. State Kirchhoff's Current and Voltage laws.
27. An $500 \mu\text{H}$, $\frac{80}{\pi^2}$ pF capacitor and a 628Ω resistor are connected to form a series RLC circuit. Calculate the resonant frequency and Q-factor of this circuit at resonance.
28. Obtain Gauss's law of electrostatics from Coulomb's inverse square law.
29. Compare the properties of dia, para and ferromagnetic materials.
30. Fibre optic communication is gaining popularity among various transmission media. Justify.
31. What are the characteristics of photons?
32. Write the output (Y) Boolean expression for the following circuit with inputs A, B and C.



33. What is total internal reflection? Give the condition for the total internal reflection takes place.

[Turn Over

S2020

4

PART – IV

Note : Answer **all** the questions.

5x5=25

34. (a) Explain the construction and working of transformer and define its efficiency.

(OR)

(b) Derive the equation for the angle of deviation produced by a prism and thus obtain the expression for refractive index of material of the prism.

35. (a) Obtain the condition for bridge balance in Wheatstone's bridge.

(OR)

(b) (i) State Ampere's Circuital Law.

(ii) Find the magnetic induction due to a long straight conductor using Ampere's Circuital Law.

36. (a) Derive an expression for the radius of the orbit of electron in an atom using Bohr atom model.

(OR)

(b) (i) Write down any six properties of electromagnetic wave.

(ii) Compute the speed of electromagnetic wave in a medium if the amplitudes of electric and magnetic fields in it are $3 \times 10^4 \text{ NC}^{-1}$ and $2 \times 10^{-4} \text{ T}$ respectively.

37. (a) Obtain Lens Maker's Formula, from that derive Lens equation.

(OR)

(b) Describe the function of transistor as an amplifier with the neat circuit diagram. Sketch the input and output waveform.

38. (a) (i) Obtain Einstein's Photoelectric equation with necessary explanation.

(ii) What will happen to the stopping potential in the following cases when;

(A) Work function of the metal is increased.

(B) Intensity of incident ray is increased.

(OR)

(b) Explain in detail the effect of introducing a dielectric medium between the plates of a parallel plate capacitor, when the capacitor is disconnected from the battery.

- 0 0 0 -

**RAJENDRAN M, M.Sc., B.Ed., C.C.A., P.G. TEACHER IN PHYSICS,
SRMHSS, KAVERIYAMPOONDI, TIRUVANNAMALAI.**