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**Presidency University**

**Bengaluru**

**SCHOOL OF ENGINEERING**

**MAKE UP EXAMINATION – JAN 2023**

**Date**: 20-JAN-2023

**Time**: 1:00 pm to 4:00pm

**Max Marks**: 100

**Weightage**: 50 %

**Course Code**: PHY 101

**Course Name**: Engineering Physics

**Program**: B.Tech(All Programs)

**Instructions:**

1. *Read all the questions carefully and answer accordingly.*
2. *Question paper consists of 3 parts.*
3. Scientific and Non-programmable calculators are permitted.
4. *Given : Planck’s constant h = 6.625×10-34 Js; Boltzmann’s constant kB = 1.38×10-23 J/K , Speed of light c = 3×108 m/s, Mass of the electron m = 9.1×10-31 kg, Charge of the electron*

*e =1.6×10-19 C*

**Part A**

**Answer all the Questions. (30 Marks)**

1. (a) Acronym LASER stands for --------------- (1M) (CO2) [Knowledge]

(b) The emission of photon without being aided by any external agency is called-----------

(1M) (CO2) [Knowledge]

(c) Transmission of light in the optical fiber is based on the principle of------------

(1M) (CO2) [Knowledge]

(d) The maximum angle below which a ray of light can enter through one end of the fiber and get totally internally reflected inside the core of the fiber is called --------------

(1M) (CO2) [Knowledge]

(e) When the light enters from denser to rarer medium, the light bends-------from the normal.

(1M) (CO2) [Knowledge]

(f) ----------converts light signal into electrical signal in point to point communication system.

(1M) (CO2) [Knowledge]

(g) The de Broglie wavelength (λ) associated with a particle having mass ‘m’ and velocity ‘v’ is given by the relation------------- (1M) (CO3) [Knowledge]

(h) The rate at which the phase of the wave propagates in space is called---------------

(1M) (CO3) [Knowledge]

(i) Superconductors are those materials whose--------------falls to zero below critical temperature.

(1M) (CO1) [Knowledge]

(j) According to BCS theory, the cooper pair is pair of------------ (1M) (CO1) [Knowledge]

(k) A semiconductor in its purest form is called------------ (1M) (CO1) [Knowledge]

(l). -----------polarization occurs due to the displacement of the positively charged nucleus and the negatively charged electrons of an atom in the opposite directions when an electric field is applied.

(1M) (CO1) [Knowledge]

(m) -----------polarization occurs in liquids or solids which possess molecules with permanent dipole moment (i.e., in polar dielectrics) (1M) (CO1) [Knowledge]

(n) Solar cell is a device which converts light energy into------------energy

(1M) (CO1) [Knowledge]

(o) The minimum magnetic field required to destroy the superconductivity in the material is called------------- (1M) (CO1) [Knowledge]

2. (a) Mention the characteristic properties of matter waves. (2.5M) (CO3) [Knowledge]

(b) What is group velocity? (2.5M) (CO3) [Knowledge]

3. (a) What is attenuation? Mention the causes of attenuation in optical fibers

(2.5M) (CO2) [Knowledge]

(b) Define efficiency of solar cell. (2.5M) (CO1) [Knowledge]

4. (a) What is Meissner effect? (2.5M) (CO1) [Knowledge] (b) Define fill factor of a solar cell (2.5M) (CO1) [Knowledge]

**Part B**

**Answer all the Questions. Each Question carries 08 marks. (5Qx8M=40M)**

5. (a) Derive the relation between group velocity (Vg) and phase velocity (Vp).

(5M) (CO3) [Comprehension]

(b) The trotting speed of an elephant is 10 m/s. Calculate the associated de Broglie

wavelength. (Mass of the elephant = 1000 kg). (3M) (CO3) [Application]

6. Explain in detail the types of polarization in dielectrics. (8M) (CO1) [Comprehension]

7. (a) Derive an expression for energy density in terms of Einstein’s coefficients

(6M) (CO2) [Comprehension]

(b) Calculate the minimum energy of an electron in an infinite deep potential well of

width 4 nm. (2M) (CO3) [Application]

8. (a) A step index fiber has a numerical aperture of 0.26, core refractive index of 1.5 and core diameter of 100 μm. Calculate the refractive index of cladding. (4 M) (CO2) [Application]

(b) The ratio of population of two energy levels is 10-30. Find the wavelength of light emitted at 300 K. (4 M) (CO2) [Application]

9. (a) Show that group velocity is equal to particle velocity.

(5M) (CO3) [Comprehension]

(b) Mention any three postulates of quantum free electron theory.

(3M) (CO1) [Knowledge]

**Part C**

**Answer any three Questions. Each Question carries 10 marks. (3Qx10M=30M)**

10. Derive Schrodinger’s time independent one dimensional wave equation. (10M) (CO3) [Comprehension]

11. Obtain an expression for normalized wave function for a particle in one dimensional potential well of infinite height using Schrodinger’s time independent wave equation. (10M) (CO3) [Comprehension]

12. Derive an expression for numerical aperture in terms of refractive indices of core and cladding of an optical fiber. (10M) (CO2) [Comprehension]

13. Explain the principle, construction and working of semiconductor laser with neat diagrams.

(10M) (CO2) [Comprehension]