PRESIDENCY UNIVERSITY
BENGALURU

SCHOOL OF ENGINEERING

MAKE UP EXAMINATION – JAN 2023

Course Code: PHY 101

Course Name: Engineering Physics

Program: B.Tech(All Programs)

Date: 20-JAN-2023

Time: 1:00 pm to 4:00pm
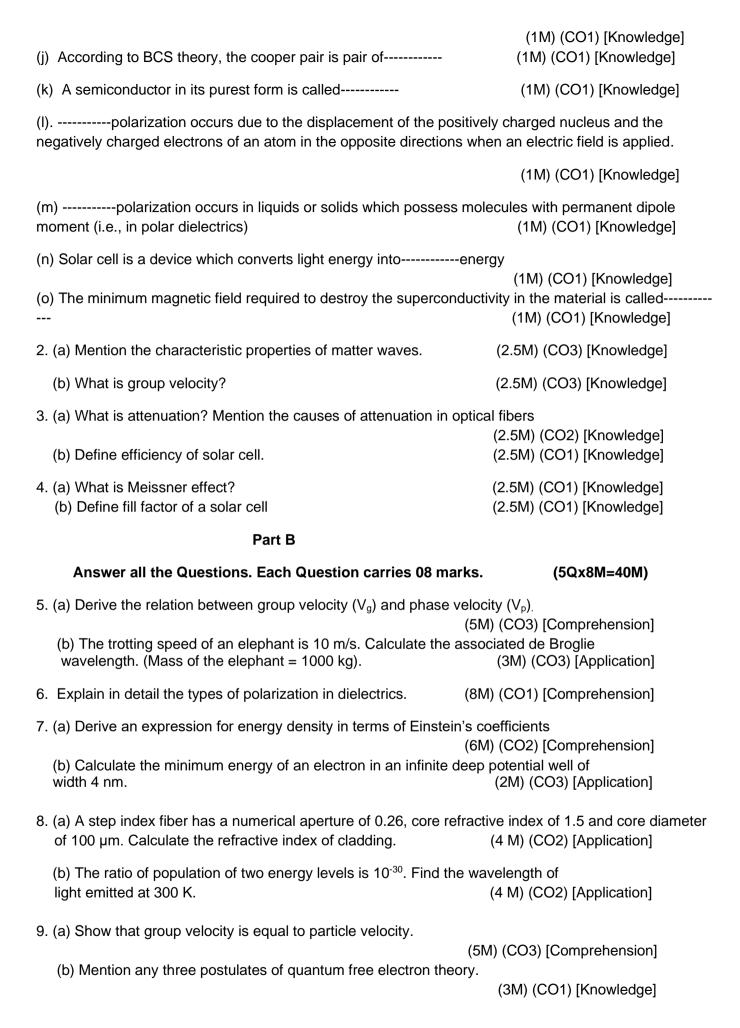
Max Marks: 100

Weightage: 50 %

Instructions:
(i) Read all the questions carefully and answer accordingly.
(ii) Question paper consists of 3 parts.
(iii) Scientific and Non-programmable calculators are permitted.
(iv) Given : Planck's constant $h = 6.625 \times 10^{-34}$ Js; Boltzmann's constant $k_B = 1.38 \times 10^{-23}$ J/K , Speed of light $c = 3 \times 10^8$ m/s, Mass of the electron $m = 9.1 \times 10^{-31}$ kg, Charge of the electron $e = 1.6 \times 10^{-19}$ 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.

(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 (V_g) and phase velocity (V_p).

(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]