

Total No. of Questions : 11]

SEAT No. :

PD-4035

[Total No. of Pages : 4

[6401]-2402

F.E.

BSC-102-BES : ENGINEERING PHYSICS

(2024 Pattern) (Semester - I/II)

Time : 2½ Hours]

[Max. Marks : 70

Instructions to the candidates:

- 1) Q.1 is compulsory.
- 2) Attempt Q.2 or Q.3, Q.4 or Q.5, Q.6 or Q.7, Q.8 or Q.9, and Q.10 or Q.11.
- 3) Neat diagrams must be drawn wherever necessary.
- 4) Assume suitable data, if necessary.

Physical Constants :

- Mass of electron $m_e = 9.1 \times 10^{-31} \text{kg}$
- Charge on electron, $e = 1.6 \times 10^{-19} \text{C}$
- Planck's constant, $h = 6.63 \times 10^{-34} \text{J-sec}$

Q1) Choose the correct answer and rewrite it.

[10]

- i) Carbon dioxide laser emits wavelength in _____
 - a) Visible region
 - b) Ultraviolet region
 - c) Infrared region
 - d) None of the Above
- ii) In optical fiber, acceptance cone is _____ the acceptance angle
 - a) Equal
 - b) Double
 - c) Half
 - d) One Third
- iii) The mater waves are _____
 - a) Electromagnetic waves
 - b) Mechanical Waves
 - c) ultrasonic waves
 - d) Neither Electromagnetic nor Mechanical Waves

P.T.O.

- iv) Wave function Ψ of a particle is
 - a) a real quantity
 - b) a complex quantity
 - c) an imaginary quantity
 - d) none of these
- v) The points of constructive interference of light are,
 - a) Always bright
 - b) May be bright or dark
 - c) Always dark
 - d) Neither bright nor dark
- vi) The Plane-polarized light, vibrations of particles in medium are in the direction to direction propagation of light.
 - a) Parallel
 - b) perpendicular
 - c) Antiparallel
 - d) None
- vii) The energy band gap size for semiconductors is in the range__ eV.
 - a) 1-2
 - b) 2-3
 - c) 3-4
 - d) > 4
- viii) The Frequency range for ultrasonic is
 - a) less than 20Hz
 - b) 20 Hz to 20 KHz
 - c) Greater Than 20 KHz
 - d) None of the above
- ix) The minimum magnetic field required to destroy superconductivity is called _____
 - a) Critical magnetic field
 - b) Applied magnetic field
 - c) External magnetic field
 - d) None
- x) Nanotechnology studies for the size of particles
 - a) 100-1000 nm
 - b) more than 100 nm
 - c) 1-100 nm
 - d) None

Q2) a) With the help of an energy level diagram, explain the construction and working of CO₂ laser. **[6]**

b) Differentiate between step index and graded index fibers. (Any three points) **[3]**

c) Calculate the numerical aperture and acceptance angle of an optical fiber having $n_1 = 1.48$ and $n_2 = 1.45$ **[3]**

OR

- Q3)** a) What is attenuation in optical fibers? Discuss in brief the various internal and external factors responsible for attenuation. [6]
- b) State characteristics of a laser. Explain any one of them in brief. [3]
- c) What is stimulated emission? Explain its significance in the production of lasers. [3]

- Q4)** a) Starting from de Broglie equation, derive Schrodinger's Time Independent wave equation. [6]
- b) State de Broglie hypothesis. Derive the equation of de Broglie wavelength by analogy with radiation. [3]
- c) Lowest energy of an electron trapped in potential well is 38 eV. Calculate the width of well. [3]

OR

- Q5)** a) For a particle trapped in a one-dimensional rigid box, derive the equation for its energy. [6]
- b) Differentiate between classical and quantum computing (any three). [3]
- c) Compute the wavelength of the De Broglie waves associated with a proton moving at 5% of the velocity of light. Proton has 1856 times the mass of one electron. (Given: $m_e = 9.1 \times 10^{-31} \text{kg}$, $c = 3 \times 10^8 \text{m/s}$). [3]

- Q6)** a) Explain interference in thin parallel film in the reflected system with a neat & labelled diagram. Calculate the total path difference. Obtain the condition of maximum and minimum. [6]
- b) Differentiate between positive and negative crystal. [3]
- c) Obtain the intensity of light transmitted by the analyzer if the angle between the polarizer and analyzer is 45° . [3]

OR

- Q7)** a) What is double refraction? Explain Huygens' theory of double refraction. [6]
- b) Explain the application of interference as an antireflection coating. [3]
- c) The wedge-shaped film with a refractive index of 1.5, is illuminated by the light of wavelength $5890 \text{\AA}$. If the angle of the wedge is 30° , Calculate the fringe width. [3]

- Q8)** a) With the help of a neat, labelled diagram, explain the Hall effect. Derive the equation of Hall voltage and Hall coefficient. [6]
- b) What are ultrasonic waves? State characteristics of ultrasonic wave. (any four) [3]
- c) An ultrasonic pulse is sent through a steel block, an echo is recorded after 1.512 microseconds, calculate the thickness of steel block if the velocity of ultrasonic waves is 5900 m/s. [3]

OR

- Q9)** a) What is an echo sounding technique? Using this technique explain the method for flaw detection using ultrasonic waves. [6]
- b) Define Fermi level for metal. Write the formula for Fermi-Dirac distribution function and explain terms involved in it. [3]
- c) In a semiconductor with a Hall coefficient of $145 \text{ cm}^3/\text{C}$ having a width of 2 cm and a thickness 0.2 cm with a magnetic field induction of 2T along the smaller dimension with a current of 150 mA. Calculate hall voltage. [3]

- Q10)a)** Explain the process of manufacturing nanoparticles using Physical Vapor Deposition. State advantages and limitations of this method. [6]
- b) What is Critical magnetic field? Write its equation and explain the terms involved in it. A superconductor has a critical temperature of 3.7 K. At 0 K the critical magnetic field is 0.0306 Tesla. What is the critical magnetic field at temperature 2 K. [6]

OR

- Q11)a)** Explain the Meissner effect. What is the cause of the Meissner effect? Show that superconductors exhibit perfect diamagnetism. [6]
- b) Explain electrical and optical properties of nanoparticles. [6]

