PE12173 [6581]-2404 F.E.

BSC-102-BES : ENGINEERING PHYSICS

(2024 Pattern) (Credit System) (Semester - I/II)

Time : 2½ Hours Max. Marks : 70

Instructions to the candidates:

1) Q.1 is compulsory

2) Solve 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, me = 9.1 × 10^-31 kg

• Charge on electron, e = 1.6 × 10^-19 C

• Planck's constant, h = 6.63 × 10^-34 J-sec

Q1) Choose the correct answer and rewrite it. [10]

a) Carbon dioxide laser emits wavelength in _____.

i) Visible region

ii) Ultraviolet region

iii) Infrared region

iv) None of the Above

b) In optical fiber, acceptance cone is _____ the acceptance angle.

i) Equal

ii) Double

iii) Half

iv) One Third

c) The matter waves are _____.

i) Electromagnetic waves

ii) Mechanical Waves

iii) Ultrasonic waves

iv) Neither Electromagnetic nor Mechanical Waves

d) Wave function Ψ of a particle is

i) A real quantity

ii) A complex quantity

iii) An imaginary quantity

iv) None of these

e) The points of constructive interference of light are,

i) Always bright

ii) May be bright or dark

iii) Always dark

iv) Neither bright nor dark

f) The Plane-polarized light, vibrations of particles in medium are in the direction _____ to direction propagation of light.

i) Inclined

ii) Perpendicular

iii) Antiparallel

iv) None

g) The energy band gap size for semiconductors is in the range _____ eV.

i) 1-2

ii) 0

iii) 3-4

iv) >4

h) The Frequency range for ultrasonic is

i) less than 20Hz

ii) 20 Hz to 20 KHz

iii) Greater Than 20-KHz

iv) None of the above

i) The minimum magnetic field required to destroy superconductivity is called _____.

i) Critical magnetic field

ii) Applied magnetic field

iii) External magnetic field

iv) None

j) Nanotechnology studies for the size of particles

i) 100-1000 nm

ii) More than 100 nm

iii) 1-100 nm

iv) None

Q2)

a) With the help of an energy level diagram, explain the construction and working of CO_2 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 n1 = 1.48 and n2 = 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: me = 9.1 × 10^-31kg, c = 3 × 10^8 m/s) [3]

Q6)

a) For a thin parallel film derive an expression for the effective path difference in the reflected system. 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 polarizer and analyzer is 45°. [3]

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 of refractive index 1.5, is illuminated by the light of wavelength 5890 Å. If the angle of the wedge is 30 seconds, calculate the fringe width. [3]

Q8)

a) State and explain 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 the terms involved in it. [3]

c) In a semiconductor with a Hall coefficient of 145 cm^3/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]