Total No. of Questions : 6]

SEAT No. :

PE12173

[Total No. of Pages : 8

[6581]-2404

E.E.

BSC-102-BES : ENGINEERING PHYSICS

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

Time : 2½ Hours] *[Max. Marks : 60*

Instructions to the candidates:

1) *Q.1 is compulsory. Attempt any one of the remaining questions.*
2) *Figures to the right indicate full marks.*
3) *Neat diagrams must be drawn wherever necessary.*
4) *Use of non-programmable electronic pocket calculators is allowed.*
5) *Assume suitable data, if necessary.*

Physical Constants:

- Plank's constant, $h = 6.63 \times 10^{-34}$ J.S
- Mass of electron, $m_e = 9.1 \times 10^{-31}$ Kg
- Charge on electron, $e = 1.6 \times 10^{-19}$ C

Q1) Write the correct option with answers for the following questions (1 mark each). **[10]**

a) The propagation of light in an optical fiber is based on the principle of:

i) Total Internal Refraction
ii) Total Intervened Reflection
iii) Total Internal Reflection
iv) Through Internal Refraction

b) The process of raising the atoms from a lower energy state to a higher one to create population inversion is called:

i) Pumping ii) Stimulated emission
iii) Spontaneous emission iv) Absorption

c) The De-Broglie's wavelength of an electron is _____ to square root of accelerating potential:

i) Equal ii) Inversely proportional
iii) Directly proportional iv) Independent

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d) The full form of STM is:

i) Scientific technical microscope

ii) Scanning tunneling microscope

iii) Super tensile microscope

iv) None of the above

e) In positive crystal the velocity of the O-ray, except optic axis is:

i) Half of the velocity of the E-ray

ii) Less than the velocity of the E-ray

iii) Greater than the velocity of the E-ray

iv) None of the above

f) If a thin film appears dark in reflected light, it will appear _____ in transmitted light as:

i) Dark ii) Bright

iii) Partially dark iv) Invisible

g) In intrinsic semiconductors Fermi level lies _____.

i) Close to Valance Band

ii) Close to Conduction Band

iii) Exactly at center between valance band and conduction band

iv) None of the above

h) In Hall effect, the Hall voltage develops is _____ to both Transverse Magnetic field and Current.

i) Incline ii) Parallel

iii) Equal iv) Perpendicular

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) Physical Vapor Deposition (PVD) method is known as:

i) Top-down method ii) Chemical etching method

iii) Lithography method iv) Bottom-up method

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Q2) a) Solve any one.

i) With a neat labeled diagram Explain construction and working of CO_2 laser. [5]

ii) Define: [5]

1) Stimulated emission
2) Population inversion
3) Resonant cavity
4) Metastable state
5) Pumping

b) Solve any one.

i) Differentiate between step index and graded index optic fibers. (Any five points). [5]

ii) Define: [5]

1) Numerical Aperture,
2) Angle of acceptance, Calculate the acceptance angle and numerical aperture for an optical fiber whose is 1.55 and cladding R.I. is 1.48.

Q3) a) Solve any one.

i) Derive Schrodinger's time Independent wave equation. [5]

ii) State properties of Matter waves. (any 3) [5]
Calculate the de-Broglie wavelength of an electron when accelerated with the P.D. of 10 KV.

b) Solve any one.

i) Obtain relation for De-Broglie's Wavelength in terms of Kinetic Energy. Find lowest energy of an electron which is confined in a Rigid box of length 1 A°. [5]

ii) With a neat diagram explain working of Scanning Tunneling Microscope. [5]

Q4) a) Solve any one.

i) Derive the equation of path difference between reflected rays when monochromatic light of wavelength 'λ' falls with angle of incidence 'i' on the uniform thickness film of refractive index μ. [5]

ii) Explain applications of interference: Anti-reflection coating. [5]
Fringes of equal thickness are obtain in a thin glass wedge of Refractive Index 1.52. The fringe spacing is 1 mm and wavelength of light is 5893 A°. Calculate the angle of wedge in seconds of an Arc.

b) Solve any one.

i) Explain the Huygens's Wave Theory of Double Refraction. [5]

ii) Explain the classification of the solids into conductors, semiconductors and insulators on the basis of band theory of solids with neat Diagrams. [5]

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Q5) a) Solve any one.

i) Draw neat labelled Energy Band diagram in following modes for PN junction diode. **[5]**

1) Reverse biased mode

2) Forward biased mode

ii) Explain production of ultrasonic waves by piezoelectric method. **[5]**

b) Solve any one.

i) What are Ultrasonics? Give any two the properties of Ultrasonic waves. An ultrasonic pulse is sent through a block of copper. The echo pulse is recorded after 5μs. If the velocity of ultrasonic in copper is 5500 m/s, calculate the thickness of the copper block. **[5]**

ii) Explain the following properties of Nano Particles. **[5]**

1) Mechanical Property

2) Electrical Property

Q6) a) Solve any one.

i) Explain the applications of Nano technology in. **[5]**

1) Targeted Drug delivery and

2) Automobile field

ii) Distinguish between types of superconductors. (Minimum 5 points) **[5]**

b) Solve any one.

i) Explain electrical and optical properties of nanoparticles. **[5]**

ii) Explain what is Meissner effect? **[5]**

The critical temp. For lead is 7.2 K. However at 5 K it loses its superconductivity when subjected to a magnetic field of 3.3×10^4 A/m. Find the maximum value of critical magnetic field which will allow to retain its superconductivity at 0 K.

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Total No. of Questions : 11]

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E.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, $m_e = 9.1 \times 10^{-31}$ kg
- Charge on electron, $e = 1.6 \times 10^{-19}$ C
- Planck's constant, $h = 6.63 \times 10^{-34}$ 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 mater 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

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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 iii) 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

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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 $n_1 = 1.48$ 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: $m_e = 9.1 \times 10^{-31}$kg, $c = 3 \times 10^8$ 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 the polarizer and analyzer is 45°. **[3]**

OR

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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 5890Å°, 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 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]**

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