

Total No. of Questions : 9]

SEAT No. :

P-3919

[Total No. of Pages : 4

[6001]-4002

F.E.

ENGINEERING PHYSICS

(2019 Pattern) (Semester - II) (Credit System) (107002)

Time : 2½ Hours]

[Max. Marks : 70

Instructions to the candidates :

- 1) Question No. 1 is compulsory.
- 2) Q.No. 2 to Q.No. 9 carry equal marks.
- 3) Figures to the right indicate full marks.
- 4) Assume suitable data, if necessary.
- 5) Use of electronic calculator is allowed.

Physical Constants :

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

Q1) Write correct option of given questions with Answer. (1 mark each) : [10]

i) According to Dr. Broglies hypothesis, the wavelength $\lambda = \frac{h}{p}$ is applicable

for

- a) Photons
- b) Matter particles
- c) Either matter particles or photons
- d) Both matter particles and photons

ii) According to Heisenberg's uncertainty principle -

a) $\Delta x \cdot \Delta p \geq \frac{h}{2n}$

b) $\Delta x \cdot \Delta p \leq \frac{h}{2n}$

c) $\Delta x \cdot \Delta p \geq \frac{h}{6n}$

d) $\Delta x \cdot \Delta p \leq \frac{h}{4n}$

P.T.O.

- iii) In Schrodinger's time independent equation _____ of a particle is independent of time.
- a) Kinetic energy b) Potential energy
c) Total energy d) Wave function
- iv) Fermi level for a metal or conductor is highest energy level occupied by electrons at _____.
- a) 0°C b) 0°F
c) 0°K d) None of the above
- v) Hall effect is true for _____.
- a) Metals only
b) Semiconductors only
c) For N-type semiconductors only
d) Both metal and semiconductors
- vi) The magnetic materials exhibit the property of magnetisation because of _____.
- a) Orbital motion of electrons b) Spin of electrons
c) Spin of nucleus d) All of the above
- vii) A superconductor is a perfect _____ material.
- a) Insulator b) Semiconductor
c) Dielectric d) Diamagnetic
- viii) Tunneling of Cooper pairs through an insulating layer between two superconductors is called _____.
- a) Josephson effect b) Onnes effect
c) Meissner effect d) Kerr effect
- ix) With increase in size of nanoparticles its hardness _____.
- a) Increases b) Decreases
c) Remains same d) Difficult to predict
- x) In Non destructive testing (NDT) the physical and chemical properties of sample _____.
- a) Changes b) Do not changes
c) Depends on temp d) Does not depend on temp

- Q2)** a) Deduce Schrodinger's time independent wave equation. [6]
- b) State and explain Heisenberg's uncertainty principle using the concept of small and large wave packet. [5]
- c) Calculate the energy difference between the ground state and first excited state of an electron in the rigid box of length 1 \AA . [4]

OR

- Q3)** a) State De Broglie's hypothesis. Derive an expression for De Broglie wavelength of an electron accelerated by a potential difference of 'V'. [6]
- b) Define wave function. Write the conditions of well behaved wave function. [5]
- c) The uncertainty in the location of a particle is equal to its De Broglie wavelength. Show that the uncertainty in the velocity to a particle is equal to the particle velocity itself. [4]

- Q4)** a) With the help of band theory of solids explain the classification of solids into conductors, semiconductors and insulators. [6]
- b) What are solar cells? Draw I-V characteristics of solar cells and define the terms i) Short circuit current and ii) Open circuit voltage. [5]
- c) The Hall coefficient of a specimen of a doped silicon is found to be $3.66 \times 10^{-4} \text{ m}^3/\text{c}$. The resistivity of the specimen is $1 \times 10^{-2} \Omega\text{m}$. Determine the mobility of the charge carriers. [4]

OR

- Q5)** a) Explain the Hall effect with a neat labelled diagram. Derive an expression for Hall voltage. [6]
- b) Define Fermi level in semiconductors. For a P-N junction diode draw energy band picture showing the position of Fermi level in i) Zero bias and ii) Forward bias. [5]
- c) Calculate the number of donor atoms which must be added to an intrinsic semiconductor to obtain the resistivity of $10^6 \Omega\text{cm}$. (Given mobility of electrons = $1000 \text{ cm}^2/\text{V sec}$.) [4]

- Q6)** a) Differentiate between diamagnetism, paramagnetism and ferromagnetism. (Any two points) [6]
b) Define : [5]
i) Magnetic permeability and
ii) Magnetic susceptibility
Obtain the relation between them.
c) The critical magnetic field of niobium is 1×10^5 A/m at 8°K and 2×10^5 A/m at 0°K. Calculate the critical temperature of the element. [4]

OR

- Q7)** a) Explain artificial magnetic field in brief. Distinguish between Type-I & Type-II superconductors. (Any 3 points). [6]
b) Explain Meissner effect in brief. Show that superconductors are characterised by perfect diamagnetism. [5]
c) Define the terms : [4]
i) Magnetic field strength (H)
ii) Magnetic induction (B)
iii) Magnetisation (M)
iv) Relation permeability (μ_r)

OR

- Q8)** a) What is echosounding technique? Using this technique explain non destructive testing for the measurement of thickness of a metal sheet using ultrasonic waves [6]
b) What is Non Destructive Testing (NDT)? Distinguish between Non Destructive Testing and Destructive Testing. (Any two points) [5]
c) Write any four applications of nanotechnology in the field of automobile. Explain any one in brief. [4]

OR

- Q9)** a) Explain optical and mechanical properties of nanoparticles [6]
b) What are nanoparticles? What is the effect of quantum confinement on the properties of nanoparticles? [5]
c) An ultrasonic pulse is sent through a copper block. The echo pulse is received after $4 \mu\text{s}$. If velocity of ultrasonic in copper is 5000 m/s, calculate the thickness of copper block. If the reflection pulse recorded after $1.253 \mu\text{s}$ from the top what is the location of flaws? [4]

