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*** $m_e = 9.1 \times 10^{-31}$ kg
2) ***Charge on electron*** $e = 1.6 \times 10^{-19}$ c
3) ***Planek's constant*** $h = 6.63 \times 10^{-34}$ 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) $\Delta x.\Delta p \geq \frac{h}{2n}$

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

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

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

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) 0ºC
b) 0ºF
c) 0ºK
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 except 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 1Aº. **[4]**

OR

Q3) a) State De Broglie's hypothesis. Derive an expression for De Broglies wavelength of an elctron 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 bond 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 3.66×10^{-4} m^3/c. The resistivity of the specimen is 1×10^{-2} Ωm. 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 donors atoms which must be added to an intrinsic semiconductors to obtain the resistivity of 10^{-6} Ωcm. (Given mobility of electrons = 1000 cm^2/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 8ºK and 2×10^5 A/m at 0ºK. 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 Melssner 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 μs. If velocity of ultrasonic in copper is 5000 m/s, calculate the thickness of copper block. If the reflection pulse recorded after 1.253 μs from the top what is the location of flaws? **[4]**

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