Total No. of Questions : 9]

SEAT No. :

PD4025

[Total No. of Pages : 4

[6401]-1902

F.E.

ENGINEERING PHYSICS

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

Time : 2½ Hours] *[Max. Marks : 70*

Instructions to the candidates:

1) ***Question No.1 is compulsory.***
2) ***Figures to the right indicate full marks.***
3) ***Assume suitable data if necessary.***
4) ***Use of electronic calculator is allowed.***

Constants :-

1) Mass of electron = Me = 9.1×10^{-31} kg
2) Charge on electron = e = 1.6×10^{-19} C
3) Planck's constant = h = 6.63×10^{-34} J.S

Q1) Write correct option of given questions with answer (one mark each) **[10]**

a) The matter waves would be associated with _____ moving with speed comparable to the speed of light.

i) Electron ii) Proton
iii) Neutron iv) All of the above

b) De Broglie hypothesis is applicable for

i) Matter particles ii) Electromagnetic waves
iii) Mechanical waves iv) None of the above

c) Heisenberg's uncertainty principle is about the _____ of position and momentum of a particle.

i) Difference ii) Addition
iii) Multiplication iv) Division

d) Which of the following represent correct ordering for band gap energy?

i) Metal > Semiconductor > Insulator
ii) Metal < Semiconductor < Insulator
iii) Metal < Semiconductor > Insulator
iv) Metal > Semiconductor < Insulator

P.T.O.

e) Hall effect is true for

i) Metals only ii) P-type semiconductors only

iii) N type semiconductors iv) All of the above

f) The relation between magnetic field strength (H), magnetization(M) and susceptibility(X) is

i) $X = M/H$ ii) $X = M + H$

iii) $X = M \times H$ iv) $X = H/M$

g) The magnetism produced in an atom is because of

i) Orbital motion of electron

ii) Spin motion of electron

iii) Spin motion of nucleus

iv) Combined effect of a, b, c

h) Below critical temperature, resistance of superconductor is _____ and it has _____ conductivity.

i) Infinite, zero ii) Unity, Unity

iii) Zero, Infinite iv) Infinite, infinite

i) _____ are performed to estimate internal defects in the materials.

i) Destructive testing ii) Non-Destructive testing

iii) Both (i) & (ii) iv) None of (i) and (ii)

j) Nanomaterials has at least one dimension in the range.

i) 1 to 100 nm ii) 100 to 1000 nm

iii) 1 to 10 μm iv) Greater than 10μm

Q2) a) Derive the expression for the energy of a particle enclosed in an infinite potential well. **[6]**

b) State and explain Heisenberg's uncertainty principle. **[5]**

c) Calculate wavelength of matter waves associated with an electron having energy 10eV. **[4]**

OR

Q3) a) Derive schrodinger's time independent equation. **[6]**

b) State and explain de Broglie hypothesis of matter waves. Write any two properties of matter waves. **[5]**

c) Calculate minimum energy associated with an electron enclosed in a potential well of length 2AV. **[4]**

Q4) a) With a suitable diagram. Explain Hall effect. Derive expression for Hall Voltage. **[6]**

b) Define efficiency of solar cell. State any four measures to improve efficiency of solar cells. **[5]**

c) Calculate number of acceptor atoms that are required to be added to an intrinsic silicon to achieve a resistivity of 10 ohm-cm. [Given - mobility of holes 500cm^2/V.S] **[4]**

OR

Q5) a) Derive the expression for conductivity of intrinsic and extrinsic semiconductors. **[6]**

b) Define Fermi level in conductor. Using Fermi-Dirac distribution function. Calculate the probability of finding electrons at T = 0 K for energy levels. **[5]**

i) $E < E_f$

ii) $E > E_f$

c) A strip of copper of thickness 1.5×10^{-4} m is placed in a magnetic field of 1T acting along its thickness; A current of 10A is setup along its length. The voltage developed across width is 5μV. Calculate concentration of charge carriers. **[4]**

Q6) a) Explain how the information is recorded and retrieved (read) in magnetic storage devices. **[6]**

b) Explain in brief :

i) Magnetic field strength (H)

ii) Magnetization (M)

Write relation between them.

c) The critical temperature for lead is Tc = 7.18k, critical magnetic field at 0 K, $H_c(O) = 6.5 \times 10^4$ A/M. Calculate critical magnetic field $H_c(T)$ at T = 4.2k. **[4]**

OR

Q7) a) State and explain meissner effect. Show that super conductors are perfect diamagnetic. **[6]**

b) Define critical magnetic field. Differentiate between type I & type II super conductors. (Any two points). **[5]**

c) Explain in brief : **[4]**

i) Magnetic induction (B)

ii) Magnetic permeability (μ)

Q8) a) Explain with a suitable diagram, how ultrasonic testing technique is used for flow defection. **[6]**

b) What is Non Destructive Testing (NDT)? Write advantages of Non Destructive Testing over destructive testing (any four). **[5]**

c) Explain applications of nanotechnology in medicine (targeted drug delivery). **[4]**

OR

Q9) a) Explain optical and electrical properties of nano particles. **[6]**

b) What is nanotechnology? Explain why properties of nanoparticles are different than corresponding bulk materials. **[5]**

c) A block of metal has a thickness of 0.5 cm. An ultrasonic pulse of velocity 5000 m/s is sent through the top of the block. After what time echo would be received from the bottom of the block. At some other location in the block. Echo is received from. Flow after 1.5μs. Calculate location of the flow. **[4]**