Total No. of Questions : 9]

SEAT No. :

PE-896

[Total No. of Pages : 4

[6581]-1902

F.E. (Common)

ENGINEERING PHYSICS

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

Time : 2½ Hours] *[Max. Marks : 70*

Instructions to the candidates :

1) ***Q. 1 is compulsory, Answer Q2 or Q3, Q4 or Q5, Q6 or Q7, Q8 or Q9.***
2) ***Neat diagrams must be drawn wherever necessary.***
3) ***Figures to the right indicates full marks.***
4) ***Use of Electronic pocket calculator is allowed.***
5) ***Assume suitable data, if necessary.***

Physical Constants: -

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

Q1) Write the correct option with answer for the following (1 mark each) : **[10]**

i) Which of the following is the basic unit of information in quantum computing?

a) Bit b) Qubit

c) Byte d) Terabyte

ii) Which pair of variables is applicable to Heisenberg's uncertainty principle?

a) wavelength and energy b) position and momentum

c) charge and displacement d) atomic radius and time

iii) The concept of matter wave was suggested by

a) Heisenberg b) de Broglie

c) Schrodinger d) Laplace

P.T.O.

iv) Which is the correct ordering of the band gap energy?

a) Diamond > silicon > copper b) Diamond < silicon < copper

c) Diamond < silicon > copper d) Diamond = silicon < copper

v) Hall effect is true for

a) P-type semiconductors only

b) N-type Semiconductors only

c) metals only

d) both for Metals and semiconductors

vi) In the ferromagnetic materials, relative permeability is _____.

a) Less than 1 b) Just greater than 1

c) Significantly greater than 1 d) None of these

vii) In a Josephson junction, two superconductors are joined by a _____ of a few angstroms thickness.

a) Superconductor material b) Insulating material

c) Conducting material d) Magnetic material

viii) Below _____ temperature, superconducting material shows zero resistivity.

a) Inversion b) Conversion

c) Critical d) Superconducting

ix) A quantum wire has _____ dimensions less than 100 nm size.

a) 0 b) 1

c) 2 d) 3

x) X - ray or gamma rays are passed through a material and their absorption and scattering are analysed in

a) Acoustic emission technique

b) Ultrasonic testing

c) Radiographic techniques

d) All of the above

Q2) a) Starting from de Broglie wave equation, derive Schrodinger's Time Independent wave equation. **[6]**

b) State de Broglie hypothesis. Derive the equation of de Broglie wavelength in terms of Kinetic Energy of a particle. **[5]**

c) A neutron is trapped in infinite potential well of width 10^{-14} m. Calculate its first energy eigen value in eV. (Mass of neutron = 1.675×10^{-27} kg) **[4]**

OR

Q3) a) Derive the equation for the energy of particle is enclosed in a one-dimensional rigid box. **[6]**

b) What is Heisenberg's uncertainty Principle? Obtain Heisenberg's uncertainty relation in terms of energy and time. **[5]**

c) Calculate the De-Broglie wavelength of an electron accelerated through potential difference of 10,000 V. **[4]**

Q4) a) Derive an expression for the conductivity in an intrinsic and extrinsic Semiconductor. **[6]**

b) Define a Fermi level in semiconductor. Using Fermi-Dirac probability distribution function, show that the position of Fermi energy level in the intrinsic semiconductor is midway of the forbidden energy gap. **[5]**

c) Calculate the mobility of charge carriers in doped silicon whose conductivity is 100 $(\Omega\text{-m})^{-1}$ and the Hall coefficient is 3.6×10^{-4} m^3/coulomb. **[4]**

OR

Q5) a) State and Explain Hall Effect. Derive the equation of Hall voltage and Hall coefficient. **[6]**

b) What is photovoltaic effect? Explain the construction and working of solar cell. **[5]**

c) A sample of intrinsic germanium at room temperature has a carrier concentration of 4.41×10^{22} cm^3. Donor impurity is added in the ratio 1 donor atom per 10^8 atoms/cm^3. Determine the resistivity of the material. [mobility of electrons is 3800 cm^2/V. s] **[4]**

Q6) a) Explain the process of data is recording, retrieving and erase in magneto-optical recording devices. **[6]**

b) State and explain Meissner effect. Show that superconductors are perfect diamagnetic in nature. **[5]**

c) Calculate the critical magnetic field of wire of lead having a diameter of 1 mm at 4.2 K. The critical temperature for lead is 7.18 K and critical magnetic field at 0K is 6.5×10^4 A/m. **[4]**

OR

Q7) a) State and explain the term superconductivity. Differentiate between type I and type II superconductors (any 04 points). **[6]**

b) Define the terms Magnetic Susceptibility, Relative Permeability and obtain relation between them. **[5]**

c) Define the terms and give its SI units : **[4]**

i) Magnetic field strength (H)

ii) Magnetic flux density (B)

Q8) a) State various types of non-destructive techniques. Explain Acoustic Emission Technique in brief with applications. **[6]**

b) What is nanotechnology? Explain how quantum confinement and change in surface area to volume ratio affects the properties of nanoparticles. **[5]**

c) State different application of Nanotechnology and Explain applications of nanoparticles in targeted drug delivery. **[4]**

OR

Q9) a) Explain Optical and electrical properties of nanoparticles in details. **[6]**

b) What is NDT? Differentiate between destructive testing and non-destructive testing (any 04 points). **[5]**

c) An ultrasonic pulse of frequency 130 kHz is sent through a block of steel. The echo pulse is received after 1.695 microseconds. If velocity of ultrasonic wave in steel is 5900 m/s, calculate the thickness of the steel block and the wavelength of the pulse. **[4]**

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