Total No. of Questions : 8]

SEAT No. : ____

PC1676

[6351]-102

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F.E.

ENGINEERING PHYSICS

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

Time : 2½ Hours] ***[Max. Marks : 70***

Instructions to the candidates:

1) ***Neat diagrams must be drawn wherever necessary.***
2) ***Figures to the right indicate full marks.***
3) ***Use of logarithmic tables slide rule, Mollier charts, electronic pocket calculator and steam tables is allowed.***
4) ***Assuem Suitable data, if necessary.***

Constants:

Mass of electron = 9.1×10^{-31} kg.

Charge on electron = 1.6×10^{-19} c

Velocity of light = 3×10^{8} m/s

Planck's Constant = 6.63×10^{-34} J.s

Q1) a) State de Broglie hypothesis. Derive de Broglie's wavelength in terms of kinetic energy E and Potential difference V. **[6]**

b) What is normalisation condition, the wavefunction must satisfy? Write down the other conditions the wave function must satisfy. **[4]**

c) Show that the energy of a particle in an infinite potential well is quantised by giving the expression of energy and with energy level diagram. **[4]**

d) An electron is confined to a box of lenght 2 Å. Calculate the minimum uncertainty in its velocity. **[4]**

OR

Q2) a) Derive Schrodinger's time independent wave equation. **[6]**

b) Using $\Delta x.\Delta p = h$, prove Heisenberg's uncertainty relation of energy and time. **[4]**

c) Write down any four properties of matter waves. **[4]**

d) An electron is trapped in an infinite potential well of width 1Å calculate the lowest two permissible energies (in eV) the electron can have. **[4]**

P.T.O.

Q3) a) Explain Hall Effect. Derive the equation for Hall voltage. **[6]**

b) What is Fermi-Dirac Probability distribution function. Write the terms involved in the equation. Draw the Energy diagrams with Fermi energy level for intrinsic and extrinsic semiconductors at 0°k. **[4]**

c) Draw the I-V characteristics of solar cell and define the terms; **[4]**

i) Fill factor

ii) Open circuit voltage

iii) Short circuit current

d) Calculate the energy gap in silicon if it transparent to a radiation of wavelengths greater than or equal to 11,000 Å. **[3]**

OR

Q4) a) By using energy band theory of solids explain classification of solids into conductors, semiconductors and insulators. **[6]**

b) Draw the energy band diagrams for Forward and Reverse biasing of the P-N junction diode. **[4]**

c) Write down the experssion for conductivity of a semiconductor. Using this, find the expresions for, intrinsic semiconductors and extrinsic semiconductor. **[4]**

d) Calculate the number of acceptors to be added to a Germanium sample to obtain the resistivity of 10Ω-cm. Given μ = 17000 cm^2/V.sec. **[3]**

Q5) a) Explain the origin of magnetism in brief Differentiate between paramagnetic materials and diamagnetic materials on the basis of magnetic susceptibility & magnetic permeability. **[6]**

b) Explain Meissner effect. Show that superconductors are diamagnetic in nature. **[4]**

c) Explain the following terms: **[4]**

i) Critical magnetic field

ii) Persistent current

d) The critical temperature for lead is 7.2K. However at 5K 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 the metal to retain its superconductivity at 0°K. **[4]**

OR

Q6) a) Explain superconductivity. Differentiate between Type I & Type II superconductors (Any 4 pts). **[6]**

b) Explain in brief the process of magnetic recordingand retreiving. **[4]**

c) What is magnetic permeability. Find the relation between relative permeability (μ_r) and magnetic susceptibility (χ). **[4]**

d) The critical field of Niobium is 1×10^5 A/m at 8K and 2×10^5 at 0 K. calculate the critical temperature of the element. **[4]**

Q7) a) What is meant by Non-destructive testing. Explain Acoustic Emission testing technique. **[6]**

b) Explain optical and electrical properties of nanoparticles in brief. **[4]**

c) Differentiate between Destructive and Non-destructive testing techniques. **[4]**

d) Find the echo time of ultrasonic pulse which is travelling with the velocity of 3.1×10^3 m/s in a sheet of mild steel of thickness 9 mm. **[3]**

OR

Q8) a) What is Nanotechnology? Explain briefly the variation in properties of nanoparticles on the basis of **[6]**

i) Surface area to volume ratio

ii) Quantum confinement Effect.

b) State any two applications of nanoparticles in **[4]**

i) Automobiles and

ii) Medicine

c) Explain flaw detection method using ultrasonic testing. **[4]**

d) An ultrasonic pulse is sent through a copper block and echo is recorded after 4 μs. If velocity of ultrasonic waves is 5000 m/s, calculate the thickness of the copper block. **[3]**