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SEAT No. :

P-9067

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## F.E.

## ENGINEERING PHYSICS

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

*Time : 2½ Hours]* *[Max. Marks : 70*

***Instructions to the candidates :***

1) ***Q. 01 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 election e = 1.6 × $10^{-19}$ C***

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

i) The de Broglie wavelength is ____ proportional to mass of the particle and _____ proportional to velocity of the particle

a) Directly, directly b) Inversely, inversely,

c) Directly, inversely d) Inversely, directly

ii) If a wave function is finite, single valued, continuous and normalizable it is called as

a) Well behaved function b) Probability function,

c) Fermi function d) None of these

iii) Heisenberg Uncertainty Principle is the product of _____ in position and momentum

a) Difference b) Uncertainties

c) Addition d) Subtraction

***P.T.O.***

iv) In Hall effect, when a specimen caring current I is placed in transverse magnetic field B then electric field developed in specimen is _____ to I and B

a) parallel
b) intersect
c) perpendicular
d) none of above

v) The resistivity has unit _____

a) Ohm-m
b) Ohm
c) Ohm/m
d) Ohm/cm

vi) Superconductivity is characterized by a state of_____

a) Finite resistivity
b) Infinite resistivity
c) Zero resistivity
d) Zero conductivity

vii) Superconductor is a perfect _____ material.

a) Insulator
b) Semiconductor
c) Dielectric
d) Diamagnetic

viii) _____ materials are weakly attracted when placed in the external magnetic field

a) Paramagnetic material
b) Diamagnetic material
c) Ferromagnetic materials
d) Ferrimagnetic materials

ix) A nanoparticle has dimensions in the range

a) 10 to 100 micrometres
b) 1 to 100 nanometres,
c) 1 to 10 nanometres
d) Greater than 100 nm

x) _____ testing is used to locate voids, cracks, flaws present inside the material

a) Destructive testing
b) Both destructive and non-destructive testing
c) None in destructive and non-destructive testing
d) Non-destructive testing

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

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

c) Calculate the energy difference between the ground state and first excited state of an electron in the rigid box of length 1 A°. **[4]**

OR

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

b) State de Broglie hypothesis. Derive the equation of de Broglie wavelength for an electron accelerated by a potential difference "V". **[5]**

c) An electron has a speed of 600 m/s with an accuracy of 0.005 %. Find the uncertainty in its 4 position. **[4]**

***Q4)*** a) Explain classification of solids on the basis of Band Theory. **[6]**

b) Explain the working of PN junction diode in (a) forward bias (c) reverse bias on the basis of energy level diagram. **[5]**

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

OR

***Q5)*** a) Explain Hall effect. Derive the equation of Hall coefficient. **[6]**

b) Prove that in intrinsic semiconductor fermi level lies exactly at centre between valence band and conduction band. **[5]**

c) Calculate the conductivity of pure silicon at room temperature when concentration of carriers is $1.6 \times 10^{10}$ per cc [$\mu_e$=1500 $cm^2$/ V-sec, $\mu_h$=500$cm^2$/V-sec. **[4]**

***Q6)*** a) Differentiate between type I and type II superconductors. **[6]**

b) Define the terms: **[5]**

i) Magnetic field strength (H)

ii) Magnetization (M)

iii) Magnetic Susceptibility (χ)

iv) Magnetic Induction (B)

v) Relative Permeability (μ)

c) Explain DC and AC Josephson effect in brief. **[4]**

OR

***Q7)*** a) Explain how the information is recorded and retrieved in magneto-optical recording devices. **[6]**

b) State and Explain Meissner effect. Show that superconductors exhibit perfect diamagnetism. **[5]**

c) Differentiate ferromagnetic materials and paramagnetic material. (Any two points) **[4]**

***Q8)*** a) Explain Electrical and Mechanical properties of nanoparticles. **[6]**

b) Differentiate between Non-Destructive Testing techniques and destructive testing techniques. **[5]**

c) Explain the applications of Nano particles in Targeted Drug Dilivery. **[4]**

OR

***Q9)*** a) What is Non Destructive Testing? Explain Ultrasonic Testing Technique for flaw detection. **[6]**

b) Explain nano technology is used in, Automobile and electronics field. **[5]**

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