Total No. of Questions : 09]

SEAT No. :

**P6486**

[Total No. of Pages : 4

# [5868]-102
# F.E. (Semester - II)
# Engineering Physics
## (2019 Pattern) (Paper - II) (107002)

*Time : 2½ Hours]* *[Max. Marks : 70*

***Instructions to the candidates:***

1) ***Question No. 1 is compulsory.***
2) ***Neat diagrams must be drawn wherever necessary.***
3) ***Figures to the right indicates full marks.***
4) ***Use of logarithmic tables slide rule, Mollier charts, electronic pocket calculator and steam tables is allowed.***
5) ***Assume suitable data, if necessary.***

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***Physical Constants :-***

| | | |
|---|---|---|
| 1) | ***Planck's constant*** | $h = 6.63 \times 10^{-34}$ ***J–S*** |
| 2) | ***Mass of electron*** | $m_e = 9.1 \times 10^{-31}$ ***kg*** |
| 3) | ***Charge on electron*** | $e = 1.6 \times 10^{-19}$ ***C*** |

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***Q1)*** Write the correct option with answer for the following : **[10]**

i) The wavelength λ associated with a particle of mass m moving with velocity v is given by

a) $\lambda = \frac{h}{mv}$ b) $\lambda = \frac{mv}{h}$

c) $\lambda = \frac{hv}{m}$ d) $\lambda = \frac{m}{hv}$

ii) The equation of motion of matter wave was derived by

a) Heisenberg b) Bohr

c) De Broglie d) Schrodinger

iii) In metals the band gap energy / forbidden energy gap is

a) 0 eV b) 0.7 eV

c) 1.12 eV d) > 5 eV

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

iv) A solar cell work on the principle of

a) Photoelectric effect b) Photoluminescence effect

c) Photovoltaic effect d) Photocombustion effect

v) The relative permeability can be expressed by

a) $\mu_r = 1 + \mu_0$ b) $\mu_r = 1 + x$

c) $\mu_r = x / \mu_0$ d) $\mu_r = \mu_0 + \mu_a$

vi) Superconductivity is the phenomenon in which _____ of materials suddenly disappears below critical temperature.

a) Capacitance b) Conductivity

c) Inductance d) Resistance

vii) Ultrasonic waves have frequency

a) Less than 20 $H_z$ b) 20 $H_z$ to 20 $kH_z$

c) Greater than 20 $kH_z$ d) None of the above

viii) In nanomaterials which of the following statement is correct.

a) Surface to volume ratio is very small

b) Surface to volume ratio is large

c) Surface to volume ratio is 1 (unity)

d) None of the above

***Q2)*** a) Derive an equation for energy of a particle enclosed in 1D rigid box or in an infinite potential well. **[6]**

b) What is wave function Ψ? Write mathematical conditions of well behaved wave function. **[5]**

c) An electron is accelerated by a potential difference of 10 kV. What is De Broglie wavelength associated with this electron. **[4]**

OR

***Q3)*** a) Starting from De Broglie hypothesis, derive Schrodinger's time independent wave equation. **[6]**

b) State Heisenberg's Uncertainly principle. Explain it using the concept of narrow and broad wave packet. **[5]**

c) Lowest energy of an electron in a potential well is 38 eV. Calculate the width of well. **[4]**

***Q4)*** a) Derive an expression for conductivity of intrinsic, and extrinsic semiconductors. **[6]**

b) What is fermi level in a semiconductor? With the neat labelled diagram, draw the position of fermi level in N Type & P Type semiconductor at 0° K. **[5]**

c) A coper strip 2.0 m wide, 1.0 mm thick is placed in a magnetic field of 1.5T. If a current of 200 A is set up in the strip, calculate the Hall voltage that appears across the strip. **[5]**

Assume $R_H = 6 \times 10^{-7}$ $m^3/C$.

OR

***Q5)*** a) State Hall effect. Derive an equation of Hall voltage. **[6]**

b) Define fermi level in conductors and semiconductors. Draw the position of fermi level in intrinsic, N - type & P - type semiconductors. **[5]**

c) Calculate the number of acceptors to be added to germanium sample to obtain the resistivity of 10Ωm. **[4]**

***Q6)*** a) Explain the following terms in superconductivity : **[6]**

i) Critical Magnetic field.

ii) Meissner effect

b) Define : **[5]**

i) Magnetic induction (B)

ii) Magnetic field strength (H)

iii) Magnetization (M) and state the relation between B, M & H.

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

OR

***Q7)*** a) Differentiate between Diamagnetism, paramagnetism and ferromagnetism. (Any Three points) **[6]**

b) What is superconductivity? Distinguish between Type I and Type II superconductors. (any four points) **[5]**

c) The transition temperature for lead is 7.2 K. However at 5K it losses the superconductivity property if subjected to magnetic field of $3.3 \times 10^4$ A/m. Find the maximum value of magnetic field which will allow the metal to retain its superconductivity at 0K. **[4]**

***Q8)*** a) What is echo sounding technique? Using this technique explain non destructive testing for the measurement of thickness of metal sheet using ultrasonic waves. **[6]**

b) What are nanoparticles? What is nanotechnology? Explain the optical property of nanoparticle. **[5]**

c) Distinguish between Destructive and Non Destructive testing (any two points) **[4]**

OR

***Q9)*** a) What are applications of nanoparticles? Explain any two applications of nanoparticles in brief. **[6]**

b) Explain in brief Acoustic Emission Technique of NDT and its application. **[5]**

c) Explain electrical property of nanoparticles. **[4]**

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