Total No. of Questions : 6]

SEAT No. :

P2017

[Total No. of Pages : 3

F.E. (Common)
PHYSICS
Applied Science - II
(2008 Pattern)

Time : 2 Hours] *[Max. Marks : 50*

Instructions to the candidates:

1) ***Answer any three (1 or 2, 3 or 4, 5 or 6) questions.***
2) ***Figures to the right indicate full marks.***
3) ***Neat diagrams must be drawn wherever necessary.***
4) ***Use of logarithmic tables, slide rule, Mollier charts, electronic pocket calculator and steam tables is allowed.***
5) ***Assume suitable data, if necessary.***

Constants : $h = 6.63 \times 10^{-34}$ J.sec.
$m_e = 9.1 \times 10^{-31}$ kg
$m_p = 1.67 \times 10^{-27}$ kg
$e = 1.6 \times 10^{-19}$ C
$c = 3 \times 10^{8}$ m/sec.

Q1) a) Derive the eigen energy formula and draw the first three wave functions for a particle confined in a rigid box? **[7]**

b) Derive Schroedingers' time dependent wave equation. **[6]**

c) A proton and an alpha particle are accelerated by the same P.D. find the relation between wavelengths of their corresponding matter waves. **[4]**

OR

Q2) a) Explain group velocity and phase velocity. Derive the expression with which a wave group travels. **[7]**

b) State and illustrate Heisenberg's uncertainty principle by diffraction of electron. **[6]**

c) An electron bound by a potential which closely approaches an infinite square well of width 1AU.

Calculate the lowest three permissible energies the electron can have. **[4]**

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Q3) a) Draw a neat diagram of gas laser. Explain its principle, construction and working. **[7]**

b) Explain following properties of superconductors: **[6]**

i) Critical magnetic field

ii) Zero electrical resistance

c) Explain Holography in brief. **[4]**

OR

Q4) a) Explain population inversion and spontaneous emission. Also write down the properties and applications of lasers. **[7]**

b) With the help of energy band diagram explain construction and working of semiconductor Laser. **[6]**

c) Explain Meissner effect in superconductors. **[4]**

Q5) a) Using Fermi Dirac probability distribution function, derive an expression for the position of Fermi energy level in the intrinsic semiconductor. **[6]**

b) Explain the optical and electrical properties of nanoparticles. **[6]**

c) An N type semiconductor is to have a resistivity 10 ohmcm. Calculate the number of donor atoms which must be added to achieve this. . **[4]**

$(\mu d=500 cm^2 / VS)$

OR

Q6) a) Explain Hall Effect in semiconductors. Derive the equation of hall voltage and hall co-efficient. **[6]**

b) Explain synthesis of metal nanoparticles by colloidal route. **[6]**

c) Calculate the conductivity of a germanium sample if one donor impurity is added to the extent of one part in 10^7 germanium atoms at room temperature. (Avagodro no. = 6.02×10^{23}, atomic wt.of Ge = 72.6, mobility of electrons = 3800 cm^2/VS, density of Ge = 5.32 gm/cc) **[4]**