Total No. of Questions : 8]

SEAT No. :

P4357

[Total No. of Pages : 3

[5458]-105

F.E.

ENGINEERING PHYSICS

(2015 Pattern)

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

Instructions to the candidates:

1) ***Solve Q.1 or Q.2, Q.3 or Q.4 , Q.5 or Q.6, Q.7 or Q.8.***
2) ***Neat diagrams must be drawn wherever necessary.***
3) ***Figures to the right indicate full marks.***
4) ***Use of electronic pocket calculator is allowed.***
5) ***Assume suitable data, if necessary.***

Q1) a) What is diffraction grating? For a plane transmission grating, starting from equation of resultant amplitude and intensity, specify the terms involved. Derive conditions of maxima and minima of diffraction pattern. **[6]**

b) For an empty hall, the reverberation time is found to be 1.5 sec. When curtain cloth of 20 m^2 is suspended in the hall, reverberation time reduces to 1 sec. If the dimensions of the halls are $10 \times 8 \times 6$ m^3, calculate the absorption of curtain cloth. **[3]**

c) Explain with a suitable diagram how the principle of interference is used in an anti-reflection coating. Derive an expression for its thickness. **[3]**

OR

Q2) a) What is reverberation? Give Sabine's formula for reverberation time. What are the factors affecting reverberation time? Explain how it can be optimized by controlling these factors. **[6]**

b) What is diffraction? Distinguish between Fresnel and Fraunhofer Diffraction (Any 2 points). **[3]**

c) Calculate the intensity level of a fighter plane just leaving the runway having a sound intensity of about 100 W/m^2. **[3]**

(Given: Threshold intensity $(I_0) = 10^{-12}$ W/m^2)

P.T.O.

Q3) a) Light is incident on a quartz crystal plate at normal incidence. Explain with suitable diagram the propagation of light in following cases when optic axis is lying in the plane of incidence and is **[6]**

i) Parallel to the crystal surface

ii) Perpendicular to the crystal surface

iii) Inclined to the crystal surface

b) Calculate the conductivity of Ge sample if the donor impurity is added to an extent of one part in 10^8 Ge atoms at room temperature. Data given: $N_a = 6.023 \times 10^{23}$ atoms/gm-mole, At. Wt. of Ge = 72.6, d = 5.32 gm./cc, μ =3800 $cm^2/V\text{-}s$, e= 1.6×10^{-19}C. **[3]**

c) Give any three distinguishing features between spontaneous emission and stimulated emission. **[3]**

OR

Q4) a) Explain Hall effect. Derive the expression for Hall voltage and Hall co-efficient. **[6]**

b) What is optical activity? State the formula for specific rotation and explain the terms involved in it. **[3]**

c) Calculate the band gap energy (in eV) in silicon, given that it is transparent to radiation of wavelength greater than 11000 AU. **[3]**

($h = 6.63 \times 10^{-34}$ J-sec, $c = 3 \times 10^8$ m/s)

Q5) a) Derive expression for the energy and wave function of a particle enclosed in an infinite potential well (rigid box). **[6]**

b) Obtain an expression for Heisenberg's Uncertainty Principle for energy and time. **[4]**

c) In a TV set electrons are accelerated by a potential difference of 10 KV. Calculate the de-Broglie wavelength matter waves associated with these electrons. **[3]**

($m_e = 9.1 \times 10^{-31}$kg, $h = 6.63 \times 10^{-34}$ J.s, $e = 1.6 \times 10^{-19}$C)

OR

Q6) a) State and explain Heisenberg's Uncertainty Principle. Show that it is also applicable for energy and time. **[6]**

b) Explain wave-function ψ. Give the physical significance of $|\psi^2|$. **[4]**

c) Calculate the lowest energy and corresponding momentum of an electron confined in a rigid box of width 2 Å. **[3]**
($e = 1.6 \times 10^{-19}$ C, $h = 6.63 \times 10^{-34}$ J-sec, $m_e = 9.1 \times 10^{-31}$ kg)

Q7) a) Explain chemical method for synthesis of nanoparticles by colloidal route with the help of LaMer diagram. Give one example of synthesis of metal nanoparticles. **[6]**

b) Give brief explanation of the optical properties of nanoparticles with the help of quantum confinement effect and G Mie equation. **[4]**

c) Explain the formation of Cooper pairs in superconductors with the help of electron phonon interaction. **[3]**

OR

Q8) a) What is superconductivity? Explain Meissner effect and show that superconductors are perfectly diamagnetic. **[6]**

b) Explain the following terms of superconductivity, **[4]**

i) Critical Magnetic Field

ii) Persistent Current

c) Give brief explanation of the magnetic properties of nanoparticles with the help of hysteresis curve. **[3]**

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