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First/Second Semester B.E. Degree Examination, Dec.2016/Jan.2017
Engineering Physics

Time: 3 hrs.

Max. Marks:100

Note: 1. Answer any FIVE full questions, choosing at least two from each part.
 2. Physical constants: $h = 6.63 \times 10^{-34} \text{ JS}$, $C = 3 \times 10^8 \text{ m/s}$, $e = 1.6 \times 10^{-19} \text{ C}$,
 $1 \text{ eV} = 1.6 \times 10^{-19} \text{ J}$, $m_e = 9.1 \times 10^{-31} \text{ kg}$, $m_n = 1.674 \times 10^{-27} \text{ kg}$, $NA = 6.025 \times 10^{26} / \text{Kmol}$.

PART – A

- 1 a. Choose the correct answers for the following : (04 Marks)
- i) The wavelength (λ) associated with a particle of mass m , moving with a velocity v is given by
 A) $\lambda = \frac{h}{mv}$ B) $\lambda = \frac{hv}{m}$ C) $\lambda = \frac{mv}{h}$ D) $\lambda = \frac{m}{hv}$
- ii) In black body radiation spectrum, the Wein's distribution law is applicable for
 A) Longer wavelength B) Shorter wavelength
 C) Entire wavelength D) None of these
- iii) If the group velocity of particle is $4.7 \times 10^6 \text{ m/s}$, then its phase velocity is
 A) $6 \times 10^9 \text{ m/s}$ B) $4.7 \times 10^9 \text{ m/s}$ C) $9.4 \times 10^6 \text{ m/s}$ D) $1.91 \times 10^{10} \text{ m/s}$
- iv) Photo electric effect establishes
 A) Wave nature of light B) Particle nature of light
 C) Dual nature of light D) None of these
- b. What is Planck's radiation law? Show how Wein's law and Rayleigh-Jean's law can be derived from it. (06 Marks)
- c. Describe Davisson and Germer experiment for the justification of de Broglie waves. (06 Marks)
- d. Find the energy of neutrons in eV whose de Broglie wavelength is 1 \AA . Given the mass of neutron is $1.674 \times 10^{-27} \text{ kg}$. (04 Marks)
- 2 a. Choose the correct answers for the following : (04 Marks)
- i) The product of uncertainties between position and momentum is given by
 A) $\Delta x \Delta p \geq \lambda$ B) $\Delta x \Delta p \geq \frac{h}{4\pi}$ C) $\Delta x \Delta p \geq mv$ D) $\Delta x \Delta p \geq \frac{nh}{2\pi}$
- ii) The energy corresponding to the first permitted energy level is given by
 A) Excited energy B) Metastable state energy
 C) Zero point energy D) None of these
- iii) The wave function is acceptance wave function if it is
 A) Finite every where B) Continuous everywhere
 C) Single valued everywhere D) All of these
- iv) If the electron moves in one dimensional potential box of length 2 nm , the normalization constant is
 A) $1(\text{nm})^{-1/2}$ B) $2(\text{nm})^{-1}$ C) $[\sqrt{2} \text{ nm}]^{-1}$ D) None of these.
- b. Using time independent Schrodinger wave equation obtain the expression for the normalized wave function for a particle in one dimensional potential well of infinite height. (08 Marks)
- c. Explain Heisenberg's uncertainty principle. (04 Marks)
- d. An electron is confined to a box of length 10^{-9} m , calculate the minimum uncertainty in its velocity. (04 Marks)

- 3 a. Choose the correct answers for the following : (04 Marks)
- The free electrons in classical free electron theory are treated as
 - Rigidly fixed lattice points
 - Liquid molecules
 - Gas molecules
 - None of these
 - If the mobility of electrons in a metal increases, the resistivity
 - Increases
 - Decreases
 - Remains constant
 - None of these
 - Matthiessen's rule is given by
 - $\rho = \rho_{ph} - \rho_i$
 - $\rho = \frac{\rho_{ph}}{\rho_i}$
 - $\rho = \rho_{ph} + \rho_i$
 - $\rho = \frac{\rho_i}{\rho_{ph}}$
 - The value of Fermi function in Fermi level at $T \neq 0K$ is,
 - ZERO
 - 0.5
 - 0.75
 - 1
- b. Using the classical free electron theory, derive an expression for electrical conductivity in metals. (06 Marks)
- c. Define Fermi energy and Fermi factor. Discuss the variation of Fermi factor with temperature. (06 Marks)
- d. Calculate the conductivity of sodium given $\tau_m = 2 \times 10^{-14}$ s. Density of sodium is 971 kg/m^3 , its atomic weight is 23 and has one conduction electron per atom. (04 Marks)
- 4 a. Choose the correct answers for the following : (04 Marks)
- The electric dipole moment per unit volume is
 - Magnetization
 - Bipole moment
 - Electric polarization
 - Electric susceptibility
 - For Ferromagnetic substances, the Curie-weiss law is
 - $\psi = \frac{C}{T}$
 - $\psi = \frac{C}{T - \theta}$
 - $\psi = \frac{T - \theta}{C}$
 - $\frac{C}{T + \theta}$
 - The relation between B, M and H is
 - $H = \mu_0 (M + B)$
 - $B = \mu_0 (H + M)$
 - $M = \mu_0 (H + B)$
 - None of these
 - In the inverse piezoelectric effect
 - Ultrasonic waves are produced
 - Electromagnetic waves are produced
 - Microwaves are produced
 - None of these
- b. What is internal field? Derive an expression for the internal field in the case of one dimensional array of atoms in dielectric solids. (07 Marks)
- c. Distinguish between hard and soft magnetic materials. (05 Marks)
- d. Sulphur is elemental solid dielectric whose dielectric constant is 3.4. Calculate the electronic polarizability if its density is $2.07 \times 10^3 \text{ kg/m}^3$ and atomic weight is 32.07. (04 Marks)

PART - B

- 5 a. Choose the correct answers for the following : (04 Marks)
- Wavelength of LASER can be used as a standard of
 - Time
 - Temperature
 - Length
 - Angle
 - The lifetime of atoms in meta stable state is of the order of
 - Milliseconds
 - Microseconds
 - Nanoseconds
 - Unlimited
 - Which of these is not a LASER property?
 - Highly monochromatic
 - Highly divergent
 - Highly directional
 - Highly intense
 - Pumping technique used in semiconductor LASER is
 - Electrical discharge
 - Forward bias
 - Optical pumping
 - None of these
- b. Describe the construction and working of He-Ne LASER. (07 Marks)
- c. What is holography? Explain the principle of recording of hologram with suitable diagrams. (05 Marks)
- d. The ratio of population of two energy levels is $1,059 \times 10^{-30}$. Find the wavelength of light emitted at 330K. (04 Marks)

- 6 a. Choose the correct answers for the following : (04 Marks)
- The NA of an optical fiber is 0.2, when surrounded by air. The acceptance angle when it is in water of refractive index 1.33 is
A) 8.21° B) 8.65° C) 0.11° D) None of these
 - Superconductors are
A) Ferromagnetic B) Paramagnetic C) Anti Ferromagnetic D) Diamagnetic
 - Below critical temperature, if the temperature of superconductor is increased, the critical field
A) Increases B) Decreases
C) Remains constant D) First increases, then decreases
 - Attenuation in optical fiber is due to
A) Absorption B) Scattering C) Radiation loss D) All the above
- b. Discuss various types optical fibers with suitable diagrams. (06 Marks)
- c. Write a note on Maglev vehicles. (05 Marks)
- d. The refractive indices of the core and cladding of a step index fiber are 1.45 and 1.40 respectively and its core diameter is $45\mu\text{m}$. Calculate its relative refractive index difference, V-number at wavelength 1000nm and the number of modes. (05 Marks)
- 7 a. Choose correct answers for the following : (04 Marks)
- The relation between atomic radius R and its lattice constant 'a' in FCC is
A) $a = 2R$ B) $a = 2\sqrt{2}R$ C) $a = \frac{\sqrt{3}}{4}R$ D) $a = \frac{\sqrt{3}}{2}R$
 - The coordination number in the case of BCC is
A) 6 B) 8 C) 10 D) 12
 - A plane intercepts at a, b/2, 2c in a simple cubic cell. The miller indices of the plane are.
A) (214) B) (241) C) (421) D) (124)
 - Brogg's equation is expressed as
A) $2d\sin\theta = n\lambda$ B) $2a\sin\theta = n\lambda$ C) $2\sin\theta = n\lambda$ D) None of these
- b. What is atomic packing factor? Calculate APF in the case of BCC and FCC. (06 Marks)
- c. What are miller indices of planes? Explain how to find the miller indices of planes with an example. (06 Marks)
- d. A monochromatic X-ray beam of wavelength 1.5\AA undergoes 2nd order Bragg reflection from the plane (211) of a cubic crystal at a glancing angle of 54.38° . Calculate the lattice constant. (04 Marks)
- 8 a. Choose the correct answers for the following : (04 Marks)
- The elastic behavior of the liquid is characterized by its
A) Young's modulus B) Modulus of rigidity
C) Bulk modulus D) Poisson's ratio
 - The state of the matter around nanosize is known as
A) Liquid state B) Plasma state C) Mesoscopic state D) Solid state
 - A bulk material reduced to one dimension is called quantum
A) Dot B) Well C) Particle D) Wire
 - The frequency of ultrasonic waves is
A) $< 20\text{kHz}$ B) Between 20Hz and 20kHz
C) $> 20\text{kHz}$ D) None of these
- b. What are nanomaterials? Explain any two methods of preparation of nanomaterials with neat sketches and mention any one application. (08 Marks)
- c. Describe a method of measuring velocity of ultrasonic waves in solids. Using this how can we find the rigidity modulus of the solid? (08 Marks)
