



2



USN

--	--	--	--	--	--	--	--	--	--

10PHY12/22

First/Second Semester B.E. Degree Examination, June/July 2015
Engineering Physics

Time: 3 hrs.

Max. Marks:100

- Note:** 1. Answer any FIVE full questions, choosing at least two from each part.
2. Answer all objective type questions only in OMR sheet page 5 of the answer booklet.
3. Answer to objective type questions on sheets other than OMR will not be valued.
4. Physical constants: Planck's constant $h = 6.63 \times 10^{-34} \text{ J-S}$;

Electron mass $m_e = 9.11 \times 10^{-31} \text{ kg}$, velocity of light $c = 3 \times 10^8 \text{ m/s}$,

Newtron mass $m_n = 1.67 \times 10^{-27} \text{ kg}$, $\epsilon_0 = 8.85 \times 10^{-12} \text{ Fm}^{-1}$,

Boltzmann constant $k = 1.38 \times 10^{-23} \text{ J/K}$.

PART - A

- 1 a. Choose the correct answers for the following : (04 Marks)
- The law which describes black body radiation spectrum completely is _____
A) Stefan's law B) Wien's law C) Planck's law D) Rayleigh Jeans law
 - Photoelectric effect established the _____
A) wave nature of light B) particle nature of light
C) particle nature of matter D) wave nature of matter
 - Compton wavelength is given by $\lambda =$ _____
A) h/m_0c B) m_0c/h C) m_0c/h^2 D) h^2/m_0c^2
 - De-Broglie wavelength of an electron accelerated by 100 volt is
A) 1.226 nm B) 1.226 Å C) 1.226 μm D) 1.226 mm.
- b. Describe Davisson – Germer experiment which proved the matter wave theory. (08 Marks)
- c. Define phase velocity and show that $v_g v_p = c^2$. (04 Marks)
- d. Find the kinetic energy of a neutron in eV, whose deBroglie wavelength is 1 Å. (04 Marks)
- 2 a. Choose the correct answers for the following : (04 Marks)
- The energy of a particle in the lowest state, in one dimensional infinite potential well of width 'a' is
A) hy B) $h^2/8ma^2$ C) $h/8ma^2$ D) $h^2/8a^2$
 - Kinetic energy of an electron accelerated by a potential of 50 volts is _____
A) 50 eV B) 50 J C) 5 eV D) 5 J
 - A wave function is an acceptable one if it is
A) finite everywhere B) continuous everywhere
C) single valued everywhere D) having all these properties
 - The probability of finding a free particle trapped in a potential well of width 'a' and infinite height, in the first excited state at the midpoint 'a/2' is
A) 0.5 B) 1 C) 0 D) 0.25.
- b. State and explain Heisenberg's uncertainty principle. (04 Marks)
- c. Derive the eigen function and eigen value for a free particle in one dimensional, infinite potential well. (08 Marks)
- d. The speed of an electron is measured as $4 \times 10^5 \text{ m/s}$ with 0.01% uncertainty. Calculate the minimum uncertainty involved in the position measurement simultaneously. (04 Marks)



- 3 a. Choose the correct answers for the following : (04 Marks)
- Mobility of electrons in a metal is given by _____
A) V_d/E B) V_dE C) E/V_d D) eV_dE
 - When temperature increases the resistivity of a metal _____
A) decreases B) remain the same C) increases D) reduces to zero
 - Fermi factor for $E = E_F$ at $T > 0^\circ \text{K}$ is
A) 1 B) 0 C) 1/2 D) 2
 - As per classical free electron theory the expression for electrical conductivity is $\sigma =$
A) $m/ne^2\tau$ B) mne^2/τ C) $ne^2/m\tau$ D) $ne^2\tau/m$
- b. Explain the failure of classical free electron theory. (06 Marks)
- c. State Matthiessen's rule and explain how does electrical conductivity of a metal changes with impurity and temperature. (06 Marks)
- d. Calculate the probabilities of an electron occupying energy levels 0.02 eV above Fermi level and 0.02 eV below Fermi level at 200 K. (04 Marks)
- 4 a. Choose the correct answers for the following : (04 Marks)
- If the distance between the plates of a capacitor is doubled, the value of capacitance is
A) doubled B) increased to four times
C) halved D) remains the same
 - The polarization that occurs in the frequency range 10^{13} Hz to 10^{16} Hz is
A) electronic B) ionic C) orientational D) space charge
 - The relation connecting electric displacement D and electric field E is _____
A) $D = \epsilon + E$ B) $D \neq \epsilon E$ C) $D = \epsilon - E$ D) $D = \epsilon/E$
 - Which of the following is a piezoelectric material?
A) lead B) mica C) quartz D) iron.
- b. Give qualitative explanation for dia, Para and Ferro magnetisms. (06 Marks)
- c. Explain the four types of electric polarizations and the effect of temperature on them. (06 Marks)
- d. When a NaCl crystal is subjected to an electric field of strength 1000 V/m, the polarization produced is $4.3 \times 10^{-8} \text{ C/m}^2$. Calculate the dielectric constant of NaCl. (04 Marks)

PART - B

- 5 a. Choose the correct answers for the following : (04 Marks)
- Life time of an atom in a metastable state is of the order of
A) nano seconds B) milliseconds C) seconds D) picoseconds
 - In a He-Ne gas laser, the ratio of He atom to Ne atoms is of the order
A) 1 : 1 B) 1 : 10 C) 10 : 1 D) 100 : 1
 - Pumping process in diode laser is by
A) optical pumping B) forward bias C) electric discharge D) reverse bias
 - The method used in the measurement of atmospheric pollutants using laser is called _____
A) LIDAR B) RADAR C) SONAR D) Holography
- b. Explain the terms: induced absorption, spontaneous emission and stimulated emission and obtain an expression for the energy density of radiation under equilibrium in terms of Einsteins coefficients. (09 Marks)
- c. What are the requisites of a laser? (03 Marks)
- d. The average output power of a laser source emitting beam of wavelength 633 nm is 5 mW. Find the number of photons emitted per second by the source. (04 Marks)



- 6 a. Choose the correct answers for the following : (04 Marks)
- The acceptance angle of an optical fiber whose refractive indices of core and cladding are 1.55 and 1.50 respectively when kept in air is _____
A) 45° B) 23° C) 32° D) 39°
 - The number of modes supported by an optical fiber with V number 20 is _____
A) 200 B) 20 C) 400 D) 10
 - Number of critical magnetic fields in a type II superconductor is _____
A) zero B) one C) two D) three
 - The superconductor behaves like a perfect _____
A) Diamagnet B) paramagnet C) Ferromagnet D) Antiferromagnet
- b. With neat diagrams describe three types of optical fibers based on propagation of light. (06 Marks)
- c. Distinguish between Type I and Type II super conductors. (06 Marks)
- d. Find out the ratio between the N.As of an optical fiber with refractive indices of core 1.41 and of cladding 1.40, when kept in air and water. (04 Marks)
- 7 a. Choose the correct answers for the following : (04 Marks)
- The packing factor for bcc structure is _____
A) 0.74 B) 0.52 C) 0.48 D) 0.68
 - The co-ordination number for fcc structure is _____
A) 12 B) 8 C) 6 D) 1
 - Miller indices for a plane parallel to Y – Z plane is _____
A) (011) B) (100) C) (010) D) (001)
 - Structure of NaCl is _____
A) Simple cube B) bcc C) fcc D) none of these.
- b. Describe Bragg spectrometer and explain how the interplanar spacing in a crystal can be determined using it. (06 Marks)
- c. Define packing factor. Calculate the packing factors for simple cubic and fcc structures. (06 Marks)
- d. Copper has fcc structure with atomic radius 0.1278 nm, Calculate the interplanar spacing for (321) plane. (04 Marks)
- 8 a. Choose the correct answers for the following : (04 Marks)
- The state of matter around the nanosize is known as _____
A) solid state B) mesoscopic state C) liquid state D) plasma state
 - Number of carbon atoms in a Bucky ball is _____
A) 70 B) 90 C) 12 D) 60
 - Ultrasonics can be produced by _____
A) photoelectric effect B) Compton effect
C) reverse piezo electric effect D) thermonic emission
 - Frequency of ultrasonic's is _____
A) < 20 KHz B) > 20 KHz C) < 20 Hz D) between 20 Hz to 20 KHz.
- b. What is non destructive testing? Explain with principle, the NDT method using ultrasonic to detect the flaws in a solid. Also mention two advantages of ultrasonic NDT. (08 Marks)
- c. What is carbon nanotube? Distinguish between SWCNTs and MWCNTs. (05 Marks)
- d. Explain any three applications of carbon nanotubes. (03 Marks)