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BMS College of Engineering, Bangalore-560019

(Autonomous Institute, Affiliated to VTU, Belgaum)

July / August 2017 Supplementary Semester Examinations

Course: **Engineering Physics** Duration: **3 hrs**
Course Code: **14PY11CPHY/ 14PY21CPHY** Max Marks: **100**
Date: 25.07.2017

Instructions:

1.Answer any five full questions choosing one from each unit.

2. **Constants:** Planck's constant, $h = 6.63 \times 10^{-34}$ Js,
Mass of electron, $m_e = 9.11 \times 10^{-31}$ kg,
Charge of electron, $e = 1.602 \times 10^{-19}$ C,
Boltzmann constant, $k = 1.38 \times 10^{-23}$ J/K,
Avogadro's number, $N_A = 6.02 \times 10^{26}$ /k mol
Velocity of light, $c = 3 \times 10^{8}$ m/s
Permittivity of free space, $\varepsilon_0 = 8.854 \times 10^{-12}$ F/m

UNIT 1

1	a)	By applying Schrodinger's wave equation, obtain normalized the eigen function and eigen values for a particle in one dimensional potential well of infinite height.	10
	b)	What is de-Broglie hypothesis? Express the de-Broglie wavelength for an electron accelerated by a potential difference V volt is $\lambda = \frac{1.227}{\sqrt{V}} nm$ for non-relativistic case.	6
	c)	An electron has wavelength of 2 Å. Determine its kinetic energy and group velocity of the de-Broglie wave associated with it.	4

OR

2	a)	What is Heisenberg's uncertainty principle? Using this principle demonstrate that a free electron cannot exist within the nucleus of an atom.	8
	b)	What are Phase velocity and Group velocity? Establish the relation between phase velocity and group velocity	8
	c)	An electron is present in one dimensional potential well of width 4 Å and infinite height. What is its minimum energy and first excited state energy?	4

UNIT 2

3	a)	What are Miller indices of a plane? Write the steps followed to specify the crystal planes using Miller indices with an example. Draw (010) and (123) planes in a cubic unit cell.	8
	b)	What are imperfections in crystals? Elucidate in detail Schottky and Frenkal defects.	7
	c)	First order Bragg refection is observed in a certain cubic crystal of lattice constant. 3.14 Å with x – rays of wavelength 1.54 Å for a glancing angle of 20.3º. Determine the inter-planar spacing and the miller indices of the possible planes which may be involved in the reflection.	5

UNIT 3

4	a)	What are Fermi energy and Fermi factor? Deliberate the probability of occupation of various energy states by electrons at T = 0 K and T > 0 K, on the basis of Fermi factor, with a neat diagram.	8
	b)	Elaborate the determination of thermal conductivity of a good conductor by Forbes method.	8
	c)	The Fermi level in potassium is 2.1 eV. What are the energies for which the probabilities of occupancy at 400 K are 0.99 and 0.5?	4

UNIT 4

5	a)	What is a domain? Explain Weiss's domain theory in ferromagnetic materials.	8
	b)	What is Lorentz field? Develop Clausius – Mossotti equation.	8
	c)	The dielectric constant of sulphur is 3.4. Assuming a cubic lattice for its structure, calculate the electronic polarizability of sulphur. Given: for sulphur, density = 2.07×10^3 kg/m^3, and atomic weight = 32.07.	4

UNIT 5

6	a)	Elucidate the construction and working of He-Ne laser with the help of energy level diagram.	8
	b)	What is numerical aperture? Develop the expression for numerical aperture of an optical fiber.	8
	c)	The ratio of population of two energy levels out of which upper one corresponds to a metastable state is 1.059×10^{-30}. Determine the wavelength of light emitted at 330 K.	4

OR

7	a)	How do you classify optical fibers ? Enlighten each in detail.	8
	b)	Arrive at an expression for energy density of radiation at thermal equilibrium in terms of Einstein co-efficients.	8
	c)	The attenuation of light in an optical fiber is 3.6 dB/km. What fraction of its initial intensity remains after i) 1 km and ii) after 3 km ?	4

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