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BMS College of Engineering, Bangalore-560019

(Autonomous Institute, Affiliated to VTU, Belgaum)

January 2017 Semester End Make Up Examinations

Course: **Engineering Physics** Duration: **3 hrs**

Course Code: **14PY11CPHY** Max Marks: **100**

Date: 12.01.2017

Instructions:

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

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

UNIT 1

1	a)	Define group velocity and phase velocity. Derive the relationship between them.	6
	b)	Solve Schrödinger's wave equation for a one dimensional deep potential well of width, 'a" and find the eigen functions and eigen values of the ground and first excited state.	10
	c)	Calculate the uncertainty in the velocity of an electron if its position is located within an uncertainty equal to its deBroglie wavelength.	4

OR

2	a)	Show that an electron cannot reside inside the nucleus of an atom using uncertainty principle.	6
	b)	Give the properties of Ψ. Set up Schrodinger's wave equation for one dimensional steady state quantum system.	9
	c)	Find the eigen value of an electron in the first excited state when it is confined to a box of width $1X\ 10^{-10}$ m and the probability of finding it in the first quarter of the box.	5

UNIT 2

3	a)	Explain how to find directional indices of a facial plane, in a cubic crystal with an example.	6
	b)	Derive Bragg's law and explain the Powder method of X- ray diffraction for finding the inter-planar distance in a given specimen.	10
	c)	Draw the Miller plane and find the Miller Indices of the plane having intercepts ∞a, 1b and 2c.	4

UNIT 3

4	a)	Explain the success of Quantum free electron theory in explaining any three physical parameters defining a metal.	6
	b)	Derive classical expression for the thermal conductivity of a metal and state and prove Wiedmann – Franz law.	10
	c)	Calculate the electrical conductivity and Lorentz number of a metal at 300K with the relaxation time 10^{-14} s and thermal conductivity 123.9 W/m/K and free electron concentration $6x10^{28}$ $/m^3$.	4

UNIT 4

5	a)	Define and derive an expression for internal field of an one dimensional array of atoms in a dielectric solid.	10
	b)	Explain the hysteresis and any two properties of a soft ferromagnetic specimen using Weiss's domain theory.	6
	c)	Calculate the radius of an atom showing electronic polarizability of $9.7x10^{-41}$ Fm^2.	4

UNIT 5

6	a)	Assuming the rate equations of interaction processes, deduce the relationship between Einstein's coefficients and conditions for LASER action.	10
	b)	Give an account of three types of optical fiber.	6
	c)	The refractive indices of core and cladding are 1.50 and 1.48 respectively in an optical fiber. Find the numerical aperture and angle of acceptance.	4

OR

7	a)	Describe with the energy level diagram, the construction and working of a He-Ne LASER .	9
	b)	Obtain an expression for the numerical aperature of an optical fiber kept in air.	7
	c)	Find the fractional initial intensity after 1 km and 3 km in an optical fiber with attenuation 3.6 dB/km.	4

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