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Internal Assessment Test 1 – OCTOBER. 2018

Sub:	Engineering Physics Theory					Sub Code:	18PHY12	Branch:	Physics Cycle
Date:	16-10-2018	Duration:	90 min's	Max Marks:	50	Sem / Sec:	I / A,B,C,D,E,F,G		OBE

Answer any FIVE FULL Questions

Given: $c = 3 \times 10^8$ m/s; $h = 6.625 \times 10^{-34}$ Js; $k = 1.38 \times 10^{-23}$ J/K; $N_A = 6.02 \times 10^{26}$ /K mole; $m_e = 9.1 \times 10^{-31}$kg; $e = 1.6 \times 10^{-19}$C

		MARKS	CO	RBT
1 (a)	Using Heisenberg's uncertainty principle, prove that electrons cannot exist in the nucleus.	[06]	CO3	L3
(b)	Compare the wavelength of the photon and an electron if both have the same energy(non-relativistic) 2 eV.	[04]	CO3	L3
2 (a)	Derive the expression for one dimensional time independent Schrodinger's wave equation.	[06]	CO3	L3
(b)	The ground state energy of an electron in an infinite potential well is 40 eV. What will be its ground state energy when the width of the potential well is doubled?	[04]	CO3	L3
3 (a)	Explain the construction and working of CO_2 laser, with the help of suitable diagrams.	[07]	CO4	L4
(b)	Discuss the application of lasers in defense for range finding.	[03]	CO4	L2
4 (a)	Obtain an expression for energy density of radiation under thermal equilibrium in terms of Einstein's coefficients.	[06]	CO4	L4
(b)	If a semiconductor laser uses GaAs semiconductor which has an energy gap of 1.54 eV, calculate the ratio of population between the two energy states involved in lasing action at room temperature (300 K).	[04]	CO4	L2

PTO

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5 (a)	Derive an expression for Fermi energy (E_F) at 0 K for metals.	[7]	CO5	L3
(b)	Calculate Fermi energy, Fermi velocity and Fermi Temperature for free electrons in Copper metal if it has 1.6 x 10^{30} electrons/ m^3.	[3]	CO5	L3
6 (a)	What is Hall Effect? Obtain the expression for Hall voltage in terms of Hall coefficient.	[7]	CO5	L3
(b)	Discuss the dependence of Fermi factor (f(E)) on temperature.	[3]	CO5	L3
7 (a)	Write a note on the different types of polarization mechanisms and derive the Clausius - Mossotti equation for a solid elemental dielectric material.	[7]	CO5	L3
(b)	If a NaCl crystal is subjected to an electric field of 1000 V /m and the resulting polarization is $4.3x10^{-8}$ C/m^2, calculate the dielectric constant of NaCl.	[3]	CO5	L2
8 (a)	Derive the relation between Fermi energy and energy gap for an intrinsic semiconductor.	[6]	CO5	L3
(b)	The resistivity of intrinsic germanium semiconductor at 27^0 C is equal to 0.8 Ωm. Assuming electron and hole mobilities as 0.38 and 0.18 m^2 V^{-1} s^{-1} respectively, calculate the intrinsic carrier density.	[4]	CO5	L3

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