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NMAM INSTITUTE OF TECHNOLOGY, NITTE

(An Autonomous Institution affiliated to VTU, Belagavi)

II Sem B.E. (Credit System) Mid Semester Examinations - I, February 2016

15PH102 – ENGINEERING PHYSICS

Duration: 1 Hour — Max. Marks: 20

List of constants: Velocity of light, $c = 3 \times 10^8 ms^{-1}$, Planck's constant, $h = 6.63 \times 10^{-34}$ Js, Electron mass, $m = 9.11 \times 10^{-31}$ kg, Electron charge, $e = 1.602 \times 10^{-19}$C, Permittivity of vacuum, $\varepsilon_0 = 8.85 \times 10^{-12}$F/m, Boltzmann constant, $k = 1.38 \times 10^{-23}$J/K, Avogadro number, $N_A = 6.023 \times 10^{26}$ / k mole.

*Note: Answer any **One full question from each Unit.***

		Marks	BT*
	Unit – I		
a)	What are dielectric materials? Explain the temperature dependence of polar dielectrics.	3	L*1, L2
b)	What is internal field? Deduce an expression $E_{int} = E + P / 3\varepsilon_0$ in the case of solids and liquids. In case of gases the internal field is equal to the applied field, why?	4	L1, L4
c)	A parallel plate capacitor has a capacitance of 2μF with a dielectric of relative permittivity 80. Find the energy stored in the capacitor with and without the polarizing medium for an applied voltage of 1KV.	3	L4
a)	What are ferro-elctric materials? Explain their properties.	3	L1, L2
b)	With a neat sketch, explain the behavior of dielectric constant in AC field and disappearance of various polarization mechanisms with relevant frequency ranges.	4	L1, L3
c)	A solid dielectric material contains 5×10^{28} identical atoms/m^3 each with polarizability 3.6×10^{-40} Fm^2. Assuming the internal field is given by the Lorentz relation, calculate the ratio of the internal field to the applied field.	3	L4
	Unit – II		
a)	Discuss the probability of occupation of various energy states by electrons at T = 0K and T > 0K on the basis of Fermi factor.	3	L2
b)	Define drift velocity. On the basis of free electron theory of metals, obtain an expression for the electrical conductivity of a metal.	4	L1, L3
c)	A uniform silver wire has a resistivity of 1.54×10^{-8} ohm m, at room temperature. For an electric field of 1 volt/cm, calculate (i) the drift velocity (ii) the mobility and the (iii) the relaxation time of electrons assuming that there are 5.8×10^{28} conduction electrons per m^3 of the material.	3	L4
a)	What is Fermi level? Explain the effect of temperature on the Fermi level in an n type extrinsic semiconductor.	3	L1, L2
b)	What is Hall effect? Obtain an expression for the carrier concentration in terms of Hall voltage and relate the conductivity and the Hall coefficient.	4	L1, L3
c)	Find the temperature at which there is 2% probability that a state with an energy 0.3 eV above Fermi energy is occupied.	3	L4

BT* Bloom's Taxonomy, L* Level

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