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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 $5 \times 10^{28}$ identical atoms/$m^3$ each with polarizability $3.6 \times 10^{-40}$ $Fm^2$. 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 $1.54 \times 10^{-8}$ 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 $5.8 \times 10^{28}$ 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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