ctions: A,B,C,D,E, G

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JMAM INSTITUTE OF TECHNOLOGY, NITTE

(An Autonomous Institution affiliated to VTU, Belgaum)

II Sem B.E. (Credit System) Mid Semester Examinations – II, March 2014

13PH102 – ENGINEERING PHYSICS

n: 1 Hour

Max. Marks: 20

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

f constants: Velocity of light, $c = 3\times10^{8}\ ms^{-1}$, Planck's constant, $h = 6.63\times10^{-34}$ JS, Electron mass, $m = 9.11\times10^{-31}$ kg, Electron charge, $e = 1.602\times10^{-19}$ C, Permittivity of vacuum, $\varepsilon_0 = 8.85\times10^{-12}$ F/m, Boltzmann constant, $k = 1.38\times10^{-23}$ J/K, Avogadro number, $N_A = 6.02\times10^{26}$ / k mole

Unit – I

a) Explain the terms: (i) Population inversion (ii) Stimulated emission of radiation. Mention any four differences between a laser light and a conventional light. 3

b) With principle, explain the construction and working of a semiconductor diode laser. Write the difference between semiconductor laser and CO_2 laser. 4

c) An Nd-YAG laser pulse duration is 12ps and a power of 1W. Calculate the number of photons in each pulse, if the laser wavelength is 1060nm. 3

a) Give the general description of an optical fiber with the principle of working.. 3

b) Explain the salient features of step index optical fibers with suitable diagrams. Mention any five advantages of optical fibers in communication over conventional cables. 4

c) The number of modes that the fiber can support is 612. Find the diameter of the core with the refractive indices of 1.55 and 1.50 respectively for core and cladding when the wavelength of the propagating wave is 1400 nm. 3

Unit – II

a) Define coordination number. Calculate the coordination number and atomic packing factor of BCC by alculating the atomic radius. 3

b) Describe with suitable diagram any three types of crystal systems. Give the structural features of CsCl. 4

c) Find the Miller indices of a set of parallel planes which make intercepts in the ratio 3a:4b and parallel to Z-axis. Also calculate the interplanar distance of the planes taking the lattice to be cubic with lattice constant 2Å. 3

a) Define interplanar spacing and derive an expression for the same in terms of miller indices. 3

b) Explain the origin of continuous and characteristic X-rays. Mention any five properties of X-rays. 4

c) If the lattice constant of iron 2.5 A^0 with an atomic weight and density 55.85 and 7.85 gm/cm^3 respectively, find the type of the sublattice to which it belongs. 3

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(An Autonomous Institution affiliated to VTU, Belgaum)

I Sem B.E. (Credit System) Mid Semester Examinations – I, September 2014

14PH102 – ENGINEERING PHYSICS

Duration: 1 Hour — Max. Marks: 20

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

List of constants: Velocity of light, $c=3\times10^{8}ms^{-1}$, Planck's constant, $h=6.63\times10^{-34}$ Js, Electron mass, $m=9.11\times10^{-31}$kg, Electron charge, $e=1.6\times10^{-19}$C, Permittivity of vacuum, $\varepsilon_o = 8.85\times10^{-12}$ F/m, Boltzmann constant, $k=1.38\times10^{-23}$ J/K. Avogadro number, $N_A = 6.02 \times 10^{23}$/ g mole.

Unit – I

1. a) What is meant by internal field? Deduce an expression for the same in the case of solids and liquids. In case of gases the internal field is just equal to the applied field, why? — 04
   b) How does dielectric constant of a solid containing permanent dipoles vary with temperature? Illustrate your answer with an example. — 03
   c) The dielectric constant of diamond is 16. Assuming a cubic lattice for its structure, calculate the electronic polarizability. For diamond, density = 5.33 g/cc and atomic weight = 12.01 — 03

2. a) What is dielectric loss? With neat sketch explain the behavior of dielectric constant in AC field and disappearance of various polarization mechanisms with relevant frequency ranges. — 04
   b) What is dielectric breakdown? Summarize the various factors contributing to breakdown in dielectrics. — 03
   c) An air-filled parallel plate capacitor has a capacitance of 1.5pF. If the separation between the plates is doubled and wax is inserted between them, the capacitance increases to 3pF. Compute the dielectric constant of wax. — 03

Unit – II

3. a) On the basis of free electron theory of metals, obtain an expression for the electrical conductivity of a metal. Discuss the effect of temperature and impurity on electrical resistivity of metals. — 04
   b) Discuss the probability of occupation of various energy states by electrons at T = 0K and T > 0K on the basis of Fermi factor. — 03
   c) Calculate the drift velocity and thermal velocity of conduction electrons in copper at a temperature of 300K, when a copper wire of length 2m and resistance 0.02Ω carries a current of 15A. Given the mobility of free electrons in copper is 4.3×10^{-3} $m^2/V/s$. — 03

4. a) What is a semiconductor? Mention any four differences between conductors and semiconductors. Increase in temperature decreases the resistivity of a semiconductor, why? — 04
   b) What is Fermi level and Fermi energy? How does Fermi level behave with change in temperature in intrinsic and extrinsic n-type semiconductors. — 03
   c) Find the temperature at which there is 2% probability that a state with an energy 0.3 eV above Fermi energy is occupied. — 03

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