3E1495

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3E1495

B.Tech. IIIrd Semester (Main/Back) Examination, Feb. - 2011

Electronics & Communication Engineering

3EC5 Electronic Materials and Processes

Time : 3 Hours **Maximum Marks : 80**

Min. Passing Marks : 24

Instructions to Candidates:

*Attempt overall **five** questions, selecting **one** question from **each** unit. Schematic diagrams must be shown wherever necessary. Any data you feel missing may suitably be assumed and stated clearly.*

Unit - I

1. a) Prove the Clausius - Mosotti relation **(8)**

$$\frac{\epsilon_r^* - 1}{\epsilon_r^* + 2} = \frac{1}{3\epsilon_0} N(\alpha_e + \alpha_i)$$

approximate this relation at IR (infra red) region.

b) Explain the interfacial polarization and its dynamic response. Draw its frequency spectra and dipolar relaxation. **(8)**

OR

a) Derive the temperature - independent condition. **(4)**

$$\frac{1}{L}\frac{dL}{dT} + \frac{1}{C}\frac{dC}{dT} = 0$$

For a resonant tank circuit.

b) For a solid contains 5×10^{28} atoms/m^3 with polarizability 2×10^{-38} farad m^2. Find the strength ratio of internal field to external applied field for corentz distribution. **(6)**

c) Draw the polarization with applied field for **(3+3=6)**

i) Ferro Electric and

ii) Antiferro Electric Materials.

Unit - II

2. a) Draw the susceptibility with temperature for Dia, Para, ferro, ferri and antiferromagnetic materials. **(5×2=10)**

b) The Magnetic field strength in a piece of copper is 10^6 ampere m^{-1}. Given that the Magnetic susceptibility of copper is -0.5×10^{-5}, find the flux density and the Magnetization in the copper. **(6)**

OR

a) Define **(3×4=12)**

i) initial permeability

ii) remenant magnetization

iii) coercive force

iv) saturation magnetization

On BH loop for a soft magnetic material. Compare their values from a Hard magnetic material.

b) Explain the Domain theory, Domain growth under magnetization and domain walls for a ferromagnetic materials. **(4)**

Unit - III

3. a) Write three difference for each **(3×4=12)**

i) Degenerate and Non-degenerate semiconductor material.

ii) GaAs and Si semiconductor.

iii) EGS (Electronic Grade Silicon) and MGS (Mechanical Grade Silicon).

iv) Direct and Indirect Band gap semiconductors.

b) Derive the continuity equation for P-type semiconductor that is illuminated and open-circuit. **(4)**

OR

a) A compound semiconductor is given by $\begin{pmatrix} Al & Ga & As \\ 1-x & x & y \end{pmatrix} . \begin{matrix} P \\ 1-y \end{matrix}$ then find the value of x & y for give the effective Bandgap Eg = 3.8ev. Given that Bandgap of $AlAs \rightarrow 3.8\ ev$ $GaAs \rightarrow 1.4\ ev$

$P \rightarrow 4.2\ ev.$

Also find the corresponding wavelength for which it responds maximum. **(2+6=8)**

b) How control or, depends the purity / defects on (4×2=8)

i) temperature gradient

ii) pulling / zone refining speed

iii) zone cross section / diameter of the ingot

iv) no. of cycles of zone refine

in a zone refining process.

Unit - IV

4. a) Define (5×2=10)

i) Mean free path

ii) Relaxation time

iii) Fermi velocity

iv) Scattering points

v) Drift velocity for electrons

b) Derive the relation and (6)

$$\sigma(w) = \frac{\sigma_0}{1+W^2\tau^2}$$

for metals, draw $\sigma(w)$ with frequency.

OR

a) Define the following conduction phenomena (3×3=9)

i) Hopping conduction

ii) Diffusion conduction

iii) Drift conduction.

Also state the conditions for which above phenomena applicable.

b) Write four differences between Type I and Type II semiconductor. Write the basis of BCC theory of superconductivity. (7)

Unit - V

5. a) Write the name of Mostly used capacitors used for the range (4×2=8)

i) below picofarrad

ii) nano - picofarrad

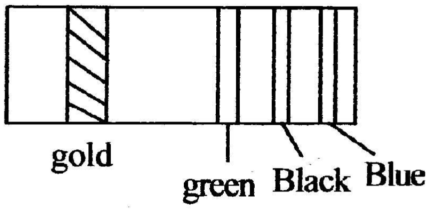
iii) microfarrad

iv) millifarrad.

Also write their power range and mechanical structures.

b) Calculate the value of resistors **(2+2+4=8)**

i)



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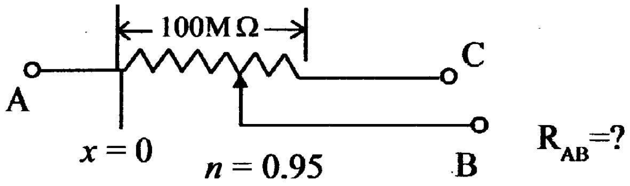

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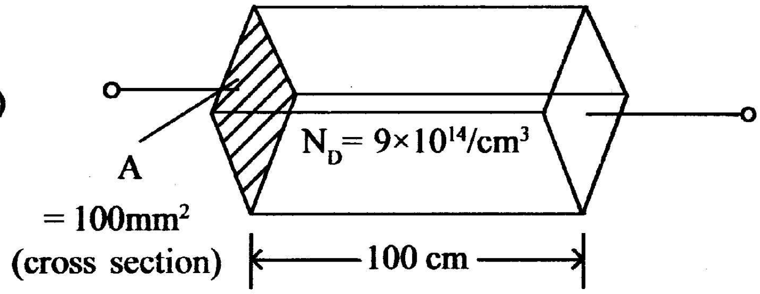

n - type silicon sample

having $n_i = 1.5\times10^{10}/\text{cm}^3$

$$K_n = 1400\ H_p = 300\ \frac{M^2.\text{volt}}{\text{Secs.}}$$

OR

Write short notes on **any four :** **(4×4=16)**

a) SOI

b) Ferrite/hexaferrite core with silicon doping

c) Laminated transformer core

d) Double layer PCB

e) Variable inductors.