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SB-3442

M. Sc. (Part - I) Examination

March / April – 2011

Electronics

(Electromagnetic fields & Waves, Physics of Electronic Materials)

Time : **3** Hours] [Total Marks : **70**

Instructions :

(1)

નીચે દર્શાવેલ ☛ નિશાનીવાળી વિગતો ઉત્તરવહી પર અવશ્ય લખવી.
Fillup strictly the details of ☛ signs on your answer book.

Name of the Examination :

☛ **M. Sc. (Part - 1)**

Name of the Subject :

☛ **Electronics**

☛ Subject Code No. : **3 4 4 2** ☛ Section No. (1, 2,.....) : **1&2**

Seat No. :

Student's Signature

(2) Answers to the two sections must be written in separate answer books.

(3) Figures to right hand side of each question indicate full marks.

(4) Assume the data if necessary.

SECTION - I

1	(a)	What is an electric dipole?	**2**
	(b)	State the poission's equation fully in spherical coordinates.	**2**
	(c)	Write statement of poyinting theorem.	**2**
	(d)	Define attenuation factor of guided and propagation constant for electromagnetic waves.	**2**
2	(a)	Derive poission and laplace equations and discuss how is it applied?	**3**
	(b)	Derive Gauss law in the presence of dielectric	**2**
	(c)	If particle having charge q moves with a velocity $\overline{u}$ in a magnetic induction $\overline{B}$, show that the work done on it vanishes.	**2**

OR

2	(a)	State and prove uniqueness theorem. Explain how the solution of electrostatic problem is the outcome of the uniqueness theorem.	**3**

(b) What is magnetic vector potential? Write Ampere's law in terms of vector potential $\bar{A}$. 2

(c) Find the vector magnetic potential for an infinitely long solenoid with T turns per unit length, radius "a" and the current "I" 4

3 (a) Derive equation for propagation of uniform plane wave in a preferred direction in a lossless dielectric. 3

(b) What is skin effect? Define skin depth and explain surface resistance in detail. 2

(c) Find the skin depth δ at a frequency of 1.6 MHz in aluminium, where $\sigma = 38.2 \times 10^5$ Mho/meter and $\mu_r = 1$. Also find the propagation constant and wave velocity. 4

OR

3 (a) Explain TEM, TE and TM modes of operation obtain a relation between the free space wavelength and guide wavelength for a rectangular wave guide of dimension (a × b). 3

(b) Explain the different antenna parameters like the radiation resistance, radiation intensity, half power beam width, the directivity and the radiation efficiency. 2

(c) A broad side array consists of 10 aerials having $\lambda/2$ common separation. Find out the width of main lobe. 4

SECTION - II

4 (a) What are the properties of reciprocal lattice? 2

(b) Distinguish between primitive Cell and Unit cell-describe the diamond structure. What type of bond is present in diamond? 3

(c) The Penetration depth for lead are 396A° and 1730 A° at 3 °k and 7.1 °k respectively. Calculate the critical temperature for lead. 3

5 (a) What are phonons? Explain thermal conductivity and scattering mechanism of phonons. 5

(b) Show that the Hall Coefficient is independent of the applied magnetic field and is inversely proportional to the current density and electronic charge. Mention some of applications of this effect. 4

OR

5 (a) (i) Distinguish the normal and unklapp process with their dispersion curves. **3**

(ii) Explain the failure of free electron model **2**

(b) Show that in a cubic crystal the spacing between consecutive parallel planes of Miller indices (h,k,l) is given by **4**

$$d_{hkl} = \frac{G}{\sqrt{h^2 + k^2 + l^2}}$$

6 (a) Obtain an expression for paramagnetic susceptibility. How does the paramagnetic susceptibility of a material vary with temperature ? **5**

(b) Metallic iron changes from BCC to FCC form at 910°C and correspondingly the atomic radii vary from 1.258A° to 1.292A°. Calculate the percentage volume charge during this structural change. **4**

OR

6 (a) Explain the phenomenon of cyclotron resonance in semiconductors. **5**

(b) X-Rays of wavelength 1.5418 A° are diffracted by (111) planes in a crystal at an angle 30° in the first order. Calculate the interatomic spacing. **4**

Use the following data if required

Avagadro's number = 6.023×10^{23} / mol

Mass of an electron m = 9.11×10^{-31} kg

Charge of an electron e = 1.6×10^{-19}

Permeability of free space $\mu_0 = 4\ \pi \times 10^{-7}$ H/meter.