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Question Paper Code : 18157

M.E. DEGREE EXAMINATION, NOVEMBER/DECEMBER 2016.

Elective

VLSI Design

VL 7011 — SIGNAL INTEGRITY FOR HIGH SPEED DEVICES

(Regulations 2013)

Time : Three hours Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. List the various issues pertaining to failure of signal integrity.

2. Write Maxwell's equations in their differential form.

3. Define Cross talk.

4. Define Skin depth. What is the value of skin depth of a good conductor?

5. What is fiber-Weave effect?

6. Write about orientational polarization.

7. Why differential signaling is required?

8. What is virtual reference plane?

9. What is on-chip termination?

10. What is a via?

PART B — (5 × 13 = 65 marks)

11. (a) Consider a long wire carrying current I_1 in the presence of a rigid rectangular loop carrying current I_2. Calculate the magnetic field generated by the long wire and hence calculate the magnetic force.

Or

(b) List out the various common transmission-line structures found in literature. Draw their cross section diagrams.

12. (a) Using single-line equivalent Models, calculate the effective even-and odd-mode impedances and propagation velocities for the coupled strip-lines whose capacitance and inductance matrices are given by Eq. (1) and Eq. (2) respectively. Estimate the impacts of crosstalk on the propagation delay for a 0.5-m coupled length.

$$C = \begin{bmatrix} 1.271 \times 10^{-10} & -7.213 \times 10^{-12} \\ -7.213 \times 10^{-12} & 1.271 \times 10^{-10} \end{bmatrix} F/m \qquad \text{Eq.(1)}$$

$$L = \begin{bmatrix} 3.480 \times 10^{-7} & 1.951 \times 10^{-8} \\ 1.951 \times 10^{-8} & 3.480 \times 10^{-7} \end{bmatrix} H/m. \qquad \text{Eq.(2)}$$

Or

(b) Sketch the far-end crosstalk pulse for a two-line case with no termination at the near end, and matched termination at the far end.

13. (a) Find the total capacitance of the system shown in fig. 13(a). Given that a = 13mm, b = 2.1 mm, c = 6.2 mm and d = 3.8 mm, dielectric constant of epoxy and glass are 3.2 and 6,4 respectively.

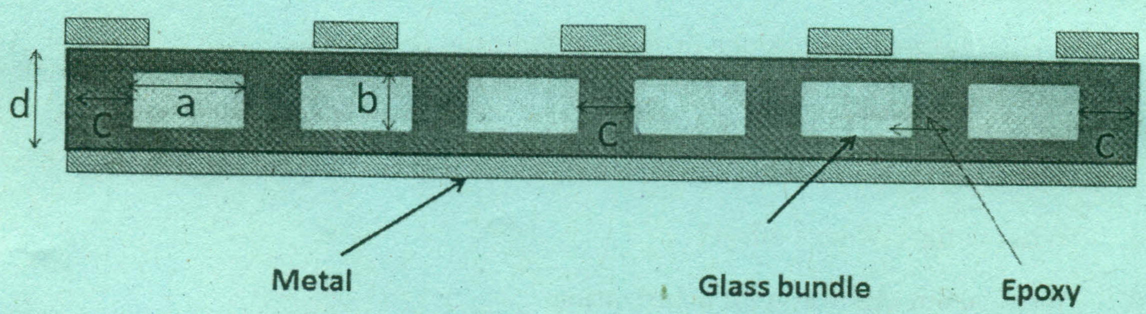

Fig. 13(a)

Or

(b) Explain the following:

(i) DC dielectric loss (4)

(ii) Single pole frequency-dependent dielectric model. (9)

14. (a) With an example, explain the differential crosstalk.

Or

(b) Explain the drawbacks of differential signaling.

15. (a) Explain the working of

(i) ESD protection circuit. (7)

(ii) CMOS receivers. (6)

Or

(b) (i) With help of a circuit explain working of a push—pull transmitter. (7)

(ii) What is path of least impedance? (6)

PART C — (1 × 15 = 15 marks)

16. (a) A TEM plane wave traveling in the z-direction with $E_x = 60V/m$. The wave length is 20cm and frequency is 1.5×10^8 Hz.

(i) Determine the relative dielectric permittivity (ε_r), the phase constant, and the intrinsic impedance. (2 × 3 = 6)

(ii) For the wave described above, write down the time-domain expressions for the E and H fields, and plot them. (6)

(iii) How much power is being transported? (3)

Or

(b) (i) Derive a model for the transmission line in terms of the equivalent inductance L and the capacitance C per unit length. (6)

(ii) Create a transmission-line model for the 20-cm transmission line as shown in fig. 16 (b) (ii). Assuming that the inductance and capacitance values are 3.54×10^{-7} H/m and C = 1.41×10^{-10} F/m respectively> Given that dielectric permittivity is 4.5, raise time and fall time of signal are 100 ps and 1000 ps respectively. (9)

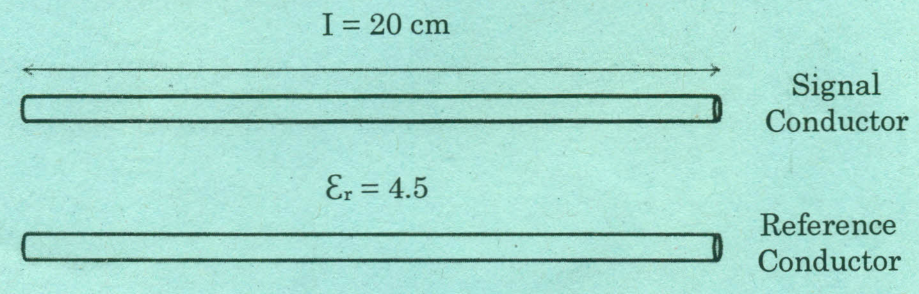

Fig. 16 (b) (ii)