UNIVERSITY OF GHANA

BACHELOR OF SCIENCE IN ENGINEERING

SECOND SEMESTER EXAMINATIONS: 2014/2015

CPEN 302 : Computer System Engineering (2 Credits)

Instructions: Attempt all questions

Time Allowed: 2 Hours

All abbreviations have their usual meaning.

QUESTION 1 (33 Marks)

a) Describe the following terms:
   - Stripline **(3 Marks)**
   - Microstrip **(3 Marks)**

b) Explain the phenomenon of reflection and characterize it for the following cases:
   - Line terminated in short-circuit **(3 Marks)**
   - Line terminated in open circuit **(3 Marks)**

c) Describe two different tools used to solve the problem of multiple reflection with transmission line. **(6 Marks)**

d) Develop an equivalent circuit model of loss-free transmission line 10 in. long for the cross section shown in figure 1. Assume that the driver has a minimum rise time of 2.5 ns and the dielectric constant is 4.9. Consider H=30 mils, W=7 mils, T=0.8 mils.

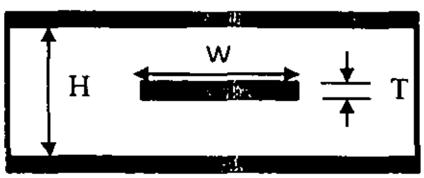

Figure 1: Model of line impedance

Note:

$$Z_o = \frac{60}{\sqrt{\varepsilon_r}} \ln\left(\frac{4H}{0.67\pi(T+0.8W)}\right)$$ **(15 Marks)**

QUESTION 2 (31 Marks)

a) Describe with the aid of diagrams, cross-talk due to:

- capacitive coupling to a floating line **(3 Marks)**
- capacitive coupling to a driven capacitive line. **(3 Marks)**

b) Discuss five countermeasures used to overcome transmission line cross-talk **(10 Marks)**

c) Classify the following noise as either internal or external and provide a definition for each of them:

- Transmitter and receiver offset **(3 Marks)**
- Power supply noise **(3 Marks)**
- Timing noise **(3 Marks)**
- Johnson noise **(3 Marks)**
- Electromagnetic interference **(3 Marks)**

QUESTION 3 (36 Marks)

The attenuation of a signal travelling down a line can be modeled by the equation below:

$$V(s,x) = V(s,0) \cdot \exp(-Ax)$$

Where A is the propagation constant given by the equation below

$$A = [(G + Cs) \cdot (R + Ls)]^{\frac{1}{2}}$$

a) Consider the network of figure 2 which consists of the model of the transmission line and evaluate the magnitude and phase of the propagation constant A above at a frequency of 100 KHz.

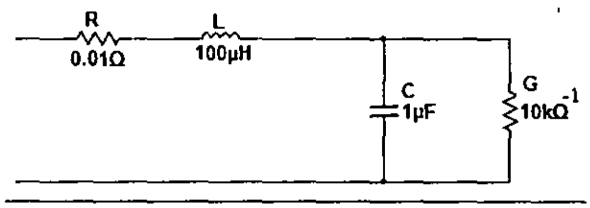

Figure 2: Model of Transmission line

(10 Marks)

b) What happens to the signal V(s, x) in the following cases

a. Only the resistor doubles **(3 Marks)**

    b. Only the capacitor doubles **(3 Marks)**
    c. Only the inductance triples **(3 Marks)**

c) Explain your observations from Q3 b) **(6 Marks)**

d) Describe the following concepts:

   - Timing convention **(2.5 Marks)**
   - Signaling convention. **(2.5 Marks)**

e) Differentiate between single supply noise and differential supply noise **(6 Marks)**