BE/ETRX/Sem VII/old
Basic of VLSI

14/12/10

Mha 2-10 11

Con. 5727-10. **GT-8013**

(OLD COURSE)

(3 Hours) **[Total Marks : 100**

N.B. : (1) Question No. **1** is **compulsory.**
(2) Attempt any **four** questions from the remaining **six** questions.
(3) Assume any **suitable** data if **necessary**.

1. (a) For a MOS capacitor on p-type silicon substrate doped with NA = 5×10^{16} cm^{-3}. Determine the surface potential required to make the surface. **20**
(i) intrinsic (ii) at strong inversion.
(b) Compare diffusion and ion implantation.
(c) Explain energy band for MOS structure.
(d) List and sketch different types of pull-up used in MOS inverter.

2. (a) Explain MOSFET operation in linear, saturation and beyond saturation showing cross-sectional view of NMOS in each region. **10**
(b) Calculate the threshold voltage V_{TO} at $V_{SB} = 0$ for polysilicon gate n-channel MOS transistor with following parameters. **10**
NA = 10^{16} cm^{-3}
ND = 2×10^{20} cm^{-3}
t_{ox} = 500 °A
N_{ox} = 4×10^{10} cm^{-2}
ϵ_0 = $8{\cdot}85 \times 10^{-14}$
ϵ_{ox} = $3{\cdot}97$ ϵ_0
ϵ_{si} = $11{\cdot}7$ ϵ_0
T = 300 °k.

3. (a) For CMOS inverter calculate output voltage as a function of input voltage. **10**
(b) Explain the latch up in CMOS what are the remedies to avoid it. **10**

4. Draw the stick diagram and layout using λ-based rule for NMOS depletion load two input NAND and two input NOR gate. Use proper color coding and aspect ratio. **20**

5. (a) Explain the methods of scaling. Show analytically how delay time power dissipation is affected in terms of scaling. **10**
(b) Explain the concept of pass transistor logic useful to implement logic function. Explain limitation of PMOS/NMOS transistor. How it can be taken care of ? **10**

BE/ ETRX/ Sem VII / old
Digital Com

Con. 6404-10. **(OLD COURSE)** **GT-8007**

(3 Hours) **[Total Marks : 100**

N.B. : (1) Question No. **1** is **compulsory**.
(2) Attempt any **four** questions out of the remaining **six** questions.
(3) Assume **suitable** data wherever required but justify the **same**.

1. Answer any **four** of the following questions – **20**
   (a) State and explain the central limit theorem of Random Variables.
   (b) Explain the spectral characteristics of line codes.
   (c) State channel capacity theorem and show that for channels of infinite bandwidth $C_\infty = 1{\cdot}44\ s/\eta$ bits/s with usual notations.
   (d) Explain the Nyquist criterion for distortionless baseband transmission.
   (e) Derive the relation for Bandwith efficiency compare the same for M-ary PSK and M-ary FSK.
   (f) Explain the viterbi algorithm of decoding of convolutional codes.

2. (a) A generator matrix of (6,3) linear block code is given as – **10**

$$G = \begin{bmatrix} 1 & 0 & 0 & 1 & 1 & 1 \\ 0 & 1 & 0 & 1 & 1 & 0 \\ 0 & 0 & 1 & 0 & 1 & 1 \end{bmatrix}$$

   (i) Determine the 'dmin' for the above code
   (ii) Comment on error correction and detection capabilities
   (iii) If the received sequence is 101101 determine the message bit sequence.

   (b) The message '1001001010' is to be transmitted in a cyclic code with a generator polynomial $g(x) = x^2+1$. **10**
   (i) Find the transmitted code word using polynomial division method.
   (ii) Draw an encoder arrangement to obtain remainder bits.

3. (a) A rate $\frac{1}{3}$ convolution encoder has generating vectors $g_1 = (1, 0, 0)$, $g_2 = (1, 1, 1)$ and $g_3 = (1, 0, 1)$. **10**
   (i) Sketch the encoder diagram
   (ii) Draw state diagram and Trellis diagram
   (iii) If input message sequence is '10110' determine the output sequence of the encoder. Use the transform domain polynomial approach.

   (b) Draw and explain the block diagram of OQPSK transmitter. A bit stream b(t) is to be transmitted using OQPSK. If b(t) is '001011011010' sketch the waveform at the output of each block of transmitter. Draw the signal space diagram of QPSK. **10**

4. (a) Explain the DPSK transmitter and receiver for the binary sequence '1100100010' is applied to the DPSK tansmitter. Sketch the resulting waveform at the transmitter output. **10**

   (b) Explain the transmitter and receiver of BFSK. Also draw the signal space diagram of orthogonal BFSK. **10**

5. (a) For a discrete memoryless source 'X' transmitting 6 symbols, x_1, x_2, x_3 -------x_6.

   $p(x_1) = 0{\cdot}3, \quad p(x_2) = 0{\cdot}25, \quad p(x_3) = 0{\cdot}2$

   $p(x_4) = 0{\cdot}12 \quad p(x_5) = 0{\cdot}08 \quad p(x_6) = 0{\cdot}05.$

   (i) Find the entropy **2**

   (ii) Construct a Huffman Code **5**

   (iii) Construct a Shannon Fano Code. **5**

   (b) Establish an algorithm for the optimum receiver, for a binary signalling scheme which maximises aposteriori probability of a correct detection in terms of the apriori and transition probabilities. **8**

6. (a) Show that a matched filter maximises output signal to noise ratio. **10**

   (b) Draw the block diagram of a due-binary encoder and explain its operation. Explain the need of precoding with an example. **10**

7. (a) Draw the block diagram of a direct sequence spread spectrum transmitter and receiver. Obtain the expression for the signal of the ouput of each block and show that the original sequence can be recovered at the receiver output. **10**

   (b) In relation to the spread spectrum, explain – **10**

   (i) slow frequency hopping

   (ii) fast frequency hopping.

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2-12-10

Con. 6181-10. Filter Theory & Application **(OLD COURSE)** **GT-8016**

(3 Hours) **[Total Marks : 100**

N.B. : (1) Question No. **1** is **compulsory**.
(2) Attempt any **four** questions out of remaining **six** questions.
(3) Assume **suitable** data whenever necessary and **justify** it.

1. (a) What is Gibb's phenomenon ? How it can be avoided by using window based method in FIR filter design. **20**
   (b) Compare Butterworth, Chebyshev and Elliptic Filter.
   (c) State the advantages and disadvantages of Digital Filter over an analog filter.
   (d) Compare FIR and IIR filter.

2. (a) Find the T.F. of a second order normalized Butterworth Filter and using impulse invariant mapping convert it to digital filter transfer function consider T=1 sec. **10**
   (b) Explain mapping between S-plane and Z-plane using impulse invariant mapping. **10**

3. (a) Design a High Pass filter having desired frequency response – **10**

$$Hd\left(e^{jw}\right) = e^{-j5w} \text{ for } \pi/4 \le |w| \le \pi$$
$$= 0 \quad \text{for } |w| \le \pi/4$$

   using hanning window.
   (b) Explain step by step procedure for the design of FIR using frequency sampling method. **10**

4. Design a Butterworth Low Pass filter using bilinear transformation with following specifications, 1dB passband at frequency 500 Hz and down 20 dB in stopband at 1200 Hz. The sampling frequency is 6000 Hz. Determine following – **20**
   (a) Passband and stopband edge frequency for an analog prototype Low Pass filter.
   (b) Find order of the Low Pass filter.
   (c) Hence find T.F. of Digital filter using B.L.T.

5. Design a digital Butterworth High Pass filter satisfying the following constraints using **20**

bilinear transformation with T=1sec $0 \cdot 85 \le |H(e^{jw})| \le 1$ for $\frac{\pi}{5} \le |w| \le \pi$

$$|H(e^{jw})| \le 0 \cdot 1 \text{ for } 0 \le |w| \le \frac{\pi}{3}.$$

5. Design a digital Butterworth High Pass filter satisfying the following constraints using bilinear transformation with T=1sec $0 \cdot 85 \leq |H(e^{jw})| \leq 1$ for $\frac{\pi}{5} \leq |w| \leq \pi$ **20**

$$|H(e^{jw})| \leq 0 \cdot 1 \text{ for } 0 \leq |w| \leq \frac{\pi}{3}.$$

6. (a) In an antisymmetric Linear phase FIR filter with order 4, if one of the zero is at 0·25, find the location of other zeros. Plot Pole-zero diagram of this filter. Hence find T.F. and impulse response of this filter. **10**

   (b) Obtain cascade and Parallel realization of IIR digital filter having transfer function – **10**

$$H(z) = \frac{(2z^2 + 5z + 4)}{(2z+1)(z+3)}.$$

7. Write short notes on – **20**
   (a) Design procedure for bessel filter
   (b) Optimal Linear phase FIR filter design
   (c) Digital to digital frequency transformation
   (d) Lattice realization in FIR and IIR filter.

B.E. / ETRX / Sem VII / old

Elective - I / Image Processing

Con. 6675-10. **(OLD COURSE)** **GT-7992**

(3 Hours) **[Total Marks : 100**

N.B. : (1) Question No. **1** is **compulsory**.
(2) Attempt any **four** questions from the remaining **six** questions.
(3) Assume **suitable** additional data if **required**, state and justify the assumptions made.

1. State whether following statements are **True** or **False** and justify the same :—
   (a) Chain code can be made invariant to translation and rotation. 5
   (b) For digital image having salt and pepper noise, median filter is the best filter. 5
   (c) Removing interpixel redundancy may or may not result in lossy compression. 5
   (d) Walsh transform is nothing but sequency ordered Hadamard matrix. 5

2. (a) Perform histogram equalization and also draw histogram for the input image and equalized image : 10

Gray leve r_k	0	1	2	3	4	5	6	7
No. of Pixels n_k	210	130	60	60	80	150	140	160

   (b) Assume that edge starts in the first row and ends in the last row for the following gray image :— 10

5	6	1
6	7	0
7	1	3

   Sketch all possible paths and determine the edge corresponding to minimum cost path.

3. (a) Explain in detail any four methods of image enhancement techniques in spatial domain. 10
   (b) The compass gradient operators of size 3 x 3 are designed to measure gradients of edge oriented in eight directions : E, NE, N, NW, W, SW, S and SE. Give the form of these eight operators. Specify the gradient direction of each mask also. 10

4. Write short notes on (any **four**) :— 20
   (a) Uniform and Non-uniform Sampling.
   (b) Enhancement in frequency domain.
   (c) Discrete Cosine transform.
   (d) Isopreference Curve.
   (e) Fourier Descriptors.

5. (a) What are the different types of redundancies in digital images ? Explain in brief with one example each. **10**

(b) Consider an 8 pixel line of grey scale data {10, 12, 14, 13, 15, 57, 54, 50}. Which has been uniformely quantized with 6 bit accuracy ? Construct its 3 bit IGS code. Decode the received IGS code. **10**

6. (a) Given x(n) = {5, 8, 20, 28, –16, –30, –8, –7} **10**
Find Hadamard and Walsh Transform of the given sequence using Fast Hadamard and Fast Walsh flow diagram.

(b) Given below is the table of 8 symbols and their frequency of occurance :— **10**

Symbol	a_0	a_1	a_2	a_3	a_4	a_5	a_6	a_7
Frequency	0·25	0·15	0·06	0·08	0·21	0·14	0·07	0·04

7. (a) Explain the method of segmentation of images by Region splitting and merging with suitable example. **10**

(b) State any five properties of 2D DFT. **10**