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06EC52

Fifth Semester B.E. Degree Examination, Dec.08/Jan.09
Digital Signal Processing

Time: 3 hrs. Max. Marks:100

Note : *1. Answer any FIVE full questions choosing at least Two questions from each part A and B.*
2. Standard notations are used.
3. Missing data if any, may be suitableley assumed.
4. Draw neat diagrams wherever necessary.

PART – A

1 a. Let X (k), $0 \le k \le N-1$ be the N point DFT of the sequence x (n), $0 \le n \le N-1$. We define

$$\hat{X}(k) = \begin{cases} X(k) & 0 \le k \le k_c, N-k_c \le k \le N-1 \\ 0 & k_c < k < N-k_c \end{cases}$$

and we compute the inverse N point DFT of $\hat{x}(k)$, $0 \le k \le N-1$. What is the effect of this process on the sequence x (n)? Explain. **(04 Marks)**

b. Determine N point DFT of $x(n) = \cos \frac{2\pi k_o n}{N}$, $0 \le n \le N-1$. **(06 Marks)**

c. State and prove the relationship between Fourier series coefficient of a continuous time signal and DFT. **(10 Marks)**

2 a. State and prove : i) Ciseular convolution property of DFT; ii) DFT of real and even sequence. **(10 Marks)**

b. Determine the response of an LTI system with h (n) = { 1, -1, 2} for an input x (n) = { 1, 0, 1, -2, 1, 2, 3, -1, 0, 2 }. Employ over lap add method with block length L = 4. **(10 Marks)**

3 a. How many complex multiplications are required for direct computation of 64 point DFT? What is its value if FFT is used? **(04 Marks)**

b. Determine 8 point DFT of x (n) = { 1, 0, -1, 2, 1, 1, 0, 2 } using radix -2 DIT FFT algorithm. Show clearly all the intermediate results. **(12 Marks)**

c. What are the two properties of phase factor W_N that are exploited in fast Fourier Transform algorithms? Prove them. **(04 Marks)**

4 a. Determine 4 point IDFT of :
X (k) = { 2.5, -0.25 + j 0.75, 0, -0.25 – j 0.75 } using DIFFFT algorithm. **(04 Marks)**

b. Consider a finite duration sequence x (n), $0 \le n \le 7$ with Z Transform, X (Z). It is desired to compute X (Z) at the following sets of values :

$Z_k = 0.8\, e^{j\left(\frac{2\pi k}{8} + \frac{\pi}{8}\right)}$; $0 \le k \le 7$.

Sketch the points Z_k in the complex plane. Determine a sequence s(n) such that its DFT provides the desired samples of X(Z). **(06 Marks)**

c. Explain Goertzal algorithm and draw the DF – II structure for the same. **(10 Marks)**

PART – B

5 a. Determine the order of Butterworth and Chebyshev approximation analog filters used to meet the following specifications : Pass band attenuation of 1 d B at 4 kHz and stop band attenuation of 40dB at 6 kHz. **(06 Marks)**

b. Design a Chebyshev type 1 analog filter to meet the following specifications : Pass band attenuation 2 d B at 4rad / sec and stop band attenuation of 10 d B at 7 rad / sec. **(14 Marks)**

6 a. Determine the FIR filter coefficients, h (n), which is symmetric low pass filter with linear phase. The desired frequency response is :

$$H_d(w) = \begin{cases} e^{-j\left(\frac{M-1}{2}\right)w} & ; \quad 0 \le |w| \le \pi/4 \\ 0 & ; \quad \text{otherwise.} \end{cases}$$

Employ rectangular window with M = 7. **(08 Marks)**

b. What is Gibbs phenomenon? How it can be reduced? **(04 Marks)**

c. Show that the roots of H(Z) occur in reciprocal pair for a linear phase FIR filter. **(08 Marks)**

7 a. Explain, how an analog filter is mapped on to a digital filter using impulse invariance method. What are the limitations of the method? **(08 Marks)**

b. Design a digital band pass filter from a 2^{nd} order analog Low pass Butterworth prototype filter using bilinear transformation. The lower and upper cutoff frequencies for band pass filter are $5\pi/12$ and $7\pi/12$. Assume T = 2sec. **(12 Marks)**

8 a. Consider a FIR filter with system function :
$H(z) = 1 + 2.82z^{-1} + 3.4048z^{-2} + 1.74z^{-3}$. Sketch the direct form and lattice realizations of the filter. **(08 Marks)**

b. For y (n) = -0.1y (n-1) + 0.2y (n-2) + 3x (n) + 3.6x (n-1) + 0.6x (n-2), obtain direct form I and II, cascade form and parallel form with single pole – zero subsystems. **(12 Marks)**

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06EC53

Fifth Semester B.E. Degree Examination, Dec.08/Jan.09
Analog Communication

Time: 3 hrs. Max. Marks:100

Note: ***Answer any FIVE full questions, selecting at least TWO questions from each part.***

PART – A

1 a. Define (i) Conditional Probabilities (ii) Random variable (iii) Mean **(06 Marks)**

b. Discuss the properties of Gaussian process. **(08 Marks)**

c. Consider a pair of a wide sense stationary random process x(t) and y(t). Show that cross correlation: $R_{xy}(\tau) = R_{xy}(-\tau)$. **(06 Marks)**

2 a. Define Demodulation. Explain the envelope detection method for amplitude modulation wave. **(06 Marks)**

b. Explain the generation of DSBSC using ring modulator. **(06 Marks)**

c. Consider a message signal m(t) with a spectrum shown in Fig.2(c). The message bandwidth w=1 kHz. This signal is applied to a product modulator, together with a carrier wave $A_c \cos(2\pi f_c t)$, producing the DSBSC modulated signal S(t). The modulated signal is next applied to a coherent detector. Assuming perfect synchronism between the carrier waves in the modulator and detector. Determine the spectrum of the detector output when:

(i) $f_c = 1.25$ kHz (ii) $f_c = 0.75$ kHz.

What is the lowest carrier frequency for which each component of the modulated signal S(t) is uniquely determined by m(t). **(08 Marks)**

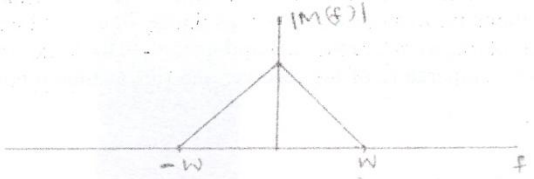

Fig.2(c)

3 a. Define Hilbert transform. Explain its properties. **(06 Marks)**

b. Derive an expression for SSB modulated wave for which lower sideband is retained. **(08 Marks)**

c. Let $S_u(t)$ denote the SSB signal obtained by transmitting only upper sideband and let $\hat{S}_u(t)$ denotes its Hilbert transform. Show that:

$$m(t) = \frac{2}{A_c}\left[S_u(t)\cos(2\pi f_c t) + \hat{S}_u(t)\sin(2\pi f_c t)\right]$$

and $$\hat{m}(t) = \frac{2}{A_c}\left[\hat{S}_u(t)\cos(2\pi f_c t) - S_u(t)\sin(2\pi f_c t)\right]$$ **(06 Marks)**

4 a. Show that a VSB modulated wave S(t) containing a vestige of the lower side band is defined by: $S(t) = \frac{A_c}{2} m(t)\cos(2\pi f_c t) - \frac{A_c}{2} m(t)\sin(2\pi f_c t)$ **(07 Marks)**

b. Explain the frequency translation. **(05 Marks)**

c. The single tone modulating signal $m(t) = A_m \cos(2\pi f_m t)$ is used to generate the VSB signal. $S(t) = \frac{1}{2} aA_m A_c \cos[2\pi(f_c + f_m)t] + \frac{1}{2} A_m A_c (1-a)\cos[2\pi(f_c - f_m)t]$ where 'a' is constant, less than unity, representing the attenuation of the upper side frequency.

(i) Find the quadrature component of the VSB signal S(t).

(ii) The VSB signal, plus the carrier $A_c \cos(2\pi f_c t)$, is passed through an envelope detector. Determine the distortion produced by the quadrature component.

(iii) What is the value of constant 'a' for which this distortion reaches its worst possible condition. **(08 Marks)**

PART –B

5 a. Explain the difference between wideband FM and narrow band FM. **(04 Marks)**

b. Explain the FM generation using indirect method. **(08 Marks)**

c. A single tone FM signal is given by: $S(t) = 10 \sin[16\pi \times 10^6 t + 20 \sin 2\pi \times 10^3 t]$ volts
Determine (i) Modulation index (ii) Modulation frequency (iii) Frequency deviation (iv) Carrier frequency and (v) power of the FM signal. **(08 Marks)**

6 a. Draw the block diagram of balance frequency discriminator and explain it for demodulation of FM signal. **(08 Marks)**

b. Explain non-linearity and its effect in FM system. **(06 Marks)**

c. Explain FM detection using PLL. **(06 Marks)**

7 a. Define : Shot noise, Thermal noise, Noise figure. **(06 Marks)**

b. Derive the relationship between noise figure and equivalent noise temperature. **(06 Marks)**

c. The receiver block diagram shown in Fig.7(c). Let T_{ant}=14°K , Te(maser)= 4°K with a gain of 30 dB, the traveling wave tube (TWT) has a noise figure F=6 dB and a gain g_a=20 dB and a mixer and IF amplifier with F=12 dB and gain g_{aT}= 40 dB. Calculate (i) the overall noise figure (ii) noise temperature of the receiver and (iii) available noise power at the receiver. **(08 Marks)**

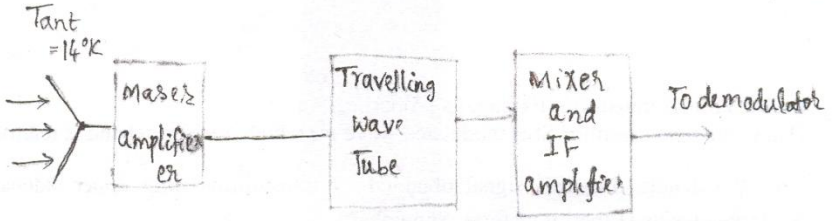

Fig.7(c)

8 a. Calculate the figure of merit ν for the DSBSC. **(07 Marks)**

b. Discuss preemphasis and deemphasis in FM. **(07 Marks)**

c. An unmodulated carrier of amplitude A_c and frequency f_c and band limited white noise are summed and then passed through an ideal detector. Assume the noise spectral density, to be of height No/2 and bandwidth 2w, centered about the carrier frequency f_c. Find the output signal to noise ratio for the case when the carrier to noise ratio is high. **(06 Marks)**

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06EC54

Fifth Semester B.E. Degree Examination, Dec.08/Jan.09
Microwaves and Radar

Time: 3 hrs. Max. Marks:100

Note : *1. Answer any FIVE full questions, choosing at least two questions form each Part.*
2. Missing data may be suitably assumed.
3. Smith chart will be provided.

PART - A

1 a. Derive equations for voltage and current at any point on a transmission line. **(10 Marks)**

b. A transmission line has the following primary constants per km of the line, R = 8Ω, G = 0.1μʊ, L = 3.5 mH and C = 9nF. Calculate Z_o, α, β, V_p and λ at w = 5000 rad/sec. **(06 Marks)**

c. What are standing waves and SWR? **(04 Marks)**

2 a. Explain in brief single stub matching. State the important expressions related to it. **(05 Marks)**

b. A load impedance of $Z_R = (60 - j80)\ \Omega$ is required to be matched to a 50 Ω coaxial line by using a short circuited stub of length L located at a distance 'd' from the load. The wave length of operation is 1 meter. Using smith chart find d and L. **(09 Marks)**

c. Explain the working of four port circulator. **(06 Marks)**

3 a. Explain TM mode of excitation of a rectangular wave guide and derive the equations. **(10 Marks)**

b. Explain the construction, working and application of Isolator based on Faraday rotation. **(06 Marks)**

c. Incident power to a directional coupler is 90W. The directional coupler has coupling factor of 20 dB directivity of 35 dB and insertion loss of 0.5 dB. Find the o/p power at main arm, coupled and Isolated parts. **(04 Marks)**

4 a. Explain the construction and working of PIN diode and IMPATT diode. **(10 Marks)**

b. Explain S – Matrix representation of multipart network. **(04 Marks)**

c. State and explain the properties of S – parameters. **(06 Marks)**

PART - B

5 a. Explain with a neat sketch a precision type variable attenuator. **(07 Marks)**

b. Explain magic tee and it's application. **(06 Marks)**

c. Explain with sketches different coaxial connectors used for microwave applications. **(07 Marks)**

6 a. Explain the Construction and field pattern for microstrip line. **(08 Marks)**

b. What are the different losses taking place in microstrip line? **(06 Marks)**

c. Compare Strip line and Microstrip line. **(06 Marks)**

7 a. With the help of a Block diagram, explain the operation of a Radar system. **(08 Marks)**

b. What are the applications of Radars? **(04 Marks)**

c. Derive Radar range and equation. **(08 Marks)**

8 a. Explain the principle and working of MTI radar with the help of a Block diagram. **(08 Marks)**

b. A radar system operates at 6GHz, 3MW power out put. If the antenna diameter is 5m and the received band width is 1.5 MHz and has a 12 dB noise figure, what is the maximum detection range for $1m^2$ target? **(06 Marks)**

c. Write brief notes on :
i) Blind speeds. ii) Delay line cancellers. **(06 Marks)**

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06EC55

Fifth Semester B.E. Degree Examination, Dec.08/Jan.09
Digital Switching Systems

Time: 3 hrs. Max. Marks:100

Note : ***1. Answer any FIVE full questions, choosing at least two questions from each part.***
2. Missing data may be suitably assumed.

PART - A

1 a. Explain in brief with a neat diagram different Network configurations and structures. **(08 Marks)**

b. Explain in brief Regulations, standards in a telecommunication network. **(06 Marks)**

c. Explain in brief Power Levels encountered in Telecommunication – Transmission systems. **(06 Marks)**

2 a. Explain in brief the operation of a Four – Wire circuit used in Two-way Transmission systems. **(08 Marks)**

b. A Four Wire Circuit has a Round-trip delay of 20ms. The Propagation time for the 2 wire circuit connected is 1ms at each end, and it's attenuation is 6 dB. The balance return loss is 3 dB, stability margin is also 3 dB. Determine:
i) Attenuation of the Talker Echo. ii) Attenuation of the Listner Echo.
iii) Delays of the Talker and Listner Echoes. **(06 Marks)**

c. Explain in brief PCM primary Multiplex group. **(06 Marks)**

3 a. Explain in brief what do you mean by message switching and circuit switching. **(06 Marks)**

b. Explain in brief different functions of a switching system. **(06 Marks)**

c. Explain in brief with a neat diagram distributed systems. **(08 Marks)**

4 a. Define and explain the following terms:
ii) Traffic Intensity; ii) Grade of service; iii) Busy hour;
iv) Blocking Probability; v) Blocking Network. **(05 Marks)**

b. Derive the Erlangs second distribution equation in case of switching systems, for a finite queue capacity. **(10 Marks)**

c. During the busy hour, on average 30E is offered to a group of trunks. On average, total period during which all trunks are busy is 12 secs and two calls are lost. Find the average no. of calls carried by the group and average call duration. **(05 Marks)**

PART - B

5 a. With a neat sketch, explain a space switch for K incoming PCM highways and m outgoing PCM highways. **(08 Marks)**

b. Discuss the need for frame Alignment in time division switching networks. Explain double ended unilateral and bilateral synchronization systems. **(12 Marks)**

6 a. Explain in brief Basic software Architecture used in digital switching systems. **(14 Marks)**

b. Explain in brief calls models and connect sequence. **(06 Marks)**

7 a. Explain in brief system outage and it's impact on DSS Reliability. **(06 Marks)**

b. Explain in brief a methodology for proper maintenance of a DSS, such as diagnostic capabilities and firmware deployment. **(08 Marks)**

c. Explain in brief a strategy for improving software quality. **(06 Marks)**

8 a. Explain in brief generic switch hardware architecture. **(06 Marks)**

b. Explain in brief common characteristics of a Digital switching system. **(08 Marks)**

c. Write short notes on:
i) Reliability Analysis or Network Control Processors. ii)Recovery Strategy. **(06 Marks)**

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06EC56

Fifth Semester B.E. Degree Examination, Dec 08 / Jan 09
Fundamentals of CMOS VLSI

Time: 3 hrs. Max. Marks:100

Note : ***Answer any FIVE full questions, selecting at least TWO from each part.***

PART - A

1 a. Explain the CMOS inverter transfer characteristics highlighting the regions of operation of the MOS transistors. **(12 Marks)**

b. Describe with neat diagrams, the P – well fabrication process. **(08 Marks)**

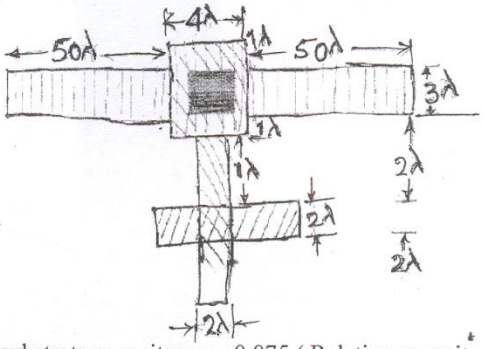
2 a. With neat diagram, explain λ - based design rules for contact cuts and Vias. **(12 Marks)**

b. Draw the stick diagram for the NMOS implementation of the Boolean expression $\overline{Y} = AB + C$. **(08 Marks)**

3 a. Discuss the merits and demerits of the following CMOS logic structures with a two input NAND gate realization as an example. i) Complementary CMOS logic ii) Pseudo NMOS logic iii) Dynamic CMOS logic. **(15 Marks)**

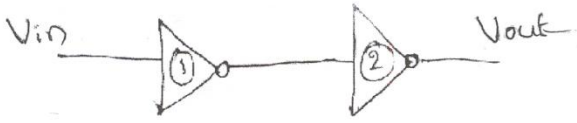
b. Explain the operation of a CMOS Transmission gate. **(05 Marks)**

4 a. For the given multilayer MOS structure, calculate the total capacitance in terms of □Cg ((5μ m) Technology) **(10 Marks)**



Given : Metal 1 to substrate capacitance = 0.075 (Relative capacitance)
Polysilicon to substrate = 0.1

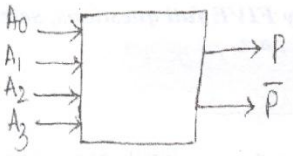
b. Describe the delay unit τ in terms of sheet resistance and area capacitance. For the CMOS inverter pair shown, calculate the total delay. **(10 Marks)**



PART – B

5 a. Describe switch and CMOS logic implementation for two input Ex – OR gate. **(08 Marks)**

b. Design a parity generator with the following specifications and draw the stick diagram for one basic cell. **(12 Marks)**



$P = \begin{cases} 1 & \text{even number of 1's} \\ 0 & \text{odd number of 1's} \end{cases}$

6 a. What is domino CMOS logic? How does it eliminate the issues related to cascading? **(10 Marks)**

b. Explain the dynamic two bit shift register circuit using NMOS and CMOS logic. **(10 Marks)**

7 a. Discuss the various system timing constraints. **(05 Marks)**

b. Explain the three transistor Dynamic RAM cell. **(10 Marks)**

c. Describe the CMOS Pseudo static D flip flop circuit. **(05 Marks)**

8 Write short notes on:

a. Latch up phenomenon.

b. BiCMOS circuit.

c. Level sensitive scan design

d. Built – in Self Test (BIST) **(20 Marks)**

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