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06EC52

Fifth Semester B.E. Degree Examination, December 2011
Digital Signal Processing

Time: 3 hrs. Max. Marks:100

Note: 1. ***Answer any FIVE full questions, selecting atleast TWO questions each from Part – A and Part - B.***
2. Use of normalized Butterworth and Chebyshev table is not permitted.

1 a. Let $x_p(n)$ be a periodic sequence with fundamental period N. Consider the following DFTs
$x_p(n) \xleftrightarrow[N]{DFT} X_1(k)$
$x_p(n) \xleftrightarrow[3N]{DFT} X_3(k)$. What is the relationship between $x_1(k)$ and $x_3(k)$? **(10 Marks)**

b. Compute the N – point DFT of the sequence $x(n) = an$, $0 \le n \le N-1$. **(10 Marks)**

2 a. Given the 8 – point sequence

$$X(n) = \begin{cases} 1, & 0 \le n \le 3 \\ 0, & 4 \le n \le 7 \end{cases}$$

Compute the DFT of the sequence $x_1(n)$ using properties of DFT.

$$X_1(n) = \begin{cases} 1, & n = 0 \\ 0, & 1 \le n \le 4 \\ 1, & 5 \le n \le 7 \end{cases}$$ **(08 Marks)**

b. What are the methods used to perform fast convolution? Explain any one method giving all the steps involved to perform fast convolution. **(07 Marks)**

c. Given the sequences $x(n) = \cos \frac{\pi n}{2}$ and $h(n) = 2^n$. Compute the 4 – point circular convolution. **(05 Marks)**

3 a. How many multiplications and additions are needed for a 64-point sequence using FFT algorithm and DFT using Direct computation? Find i) speed improvement factor
ii) number of real and complex registers needed. **(06 Marks)**

b. Prove the symmetry and periodicity property of a twiddle factor. **(06 Marks)**

c. A designer has a number of eight point FFT chips. Show explicity how he should interconnect four such chips in order to compute a 32 – point DFT. **(08 Marks)**

4 a. Describe Goertzel algorithm. Also Obtain direct form – II realization of two pole resonator for computing the DFT. **(10 Marks)**

b. What is chirp signal? What are the applications of chirp – Z transform? **(04 Marks)**

c. Let x(n) be the following 8 – point sequence.

$x(n) = \left\{ \underset{\uparrow}{\frac{1}{\sqrt{2}}}, 1, \frac{1}{\sqrt{2}}, 0, -\frac{1}{\sqrt{2}}, -1, \frac{-1}{\sqrt{2}}, 0 \right\}$. Use DIT FFT algorithm to compute DFT of the above sequence. Also show all intermediate values. **(06 Marks)**

5 a. Define Chebyshev polynomial and list all its properties. **(05 Marks)**

b. Design a Chebyshev analog filter with ripple of 0.5dB in band $|\Omega| \leq 1$ and at $\Omega = 3$, amplitude if down by 3dB. **(10 Marks)**

c. A prototype low pass filter has the system response $H(s) = \frac{1}{s^2+2s+1}$. Obtain a band pass filter with $\Omega_0 = 2$ rad/sec and $B_0 = 10$ rad/sec. **(05 Marks)**

6 a. A low pass filter is to be designed with the following desired frequency response :

$$H_d(e^{j\omega}) = \begin{cases} e^{-j2w}, & -\pi/4 \leq \omega \leq \pi/4 \\ 0, & \pi/4 < |\omega| \leq \pi \end{cases}$$

Determine the filter coefficients $h_d(n)$ if the window functions is defined as

$$\omega(n) = \begin{cases} 1, & 0 \leq n \leq 4 \\ 0, & \text{otherwise} \end{cases}$$ **(10 Marks)**

b. Determine the filter coefficients h(n) obtained by sampling $H_d(\omega)$ given by,

$$H_d(\omega) = \begin{cases} e^{-j3\omega}, & 0 < \omega < \frac{\pi}{2} \\ 0, & \frac{\pi}{2} < \omega < \pi \end{cases}$$

Also, obtain the frequency response $H(\omega)$. Take N = 7. **(10 Marks)**

7 a. Convert the analog filter into a digital filter whose system function is $H(s) = \frac{2}{(s+1)(s+3)}$ using bilinear transformation with T = 0.1 sec. **(06 Marks)**

b. Explain how an analog filter is mapped on to a digital filter using backward difference method. Using this technique convert the analog filter with system function $H(s) = \frac{1}{s+2}$ into a digital filter. **(14 Marks)**

8 a. Obtain the parallel form realization of a system function :

$$H(z) = \frac{(z-1)(z+1)(z-2)z}{\left(z-\frac{1}{2}+j\frac{1}{2}\right)\left(z-\frac{1}{2}-j\frac{1}{2}\right)\left(z-\frac{j}{4}\right)\left(z+\frac{j}{4}\right)}$$ **(08 Marks)**

b. Obtain the cascade realization for the system function given by

$$H(z) = \frac{\left(1+\frac{1}{4}z^{-1}\right)}{\left(1+\frac{1}{2}z^{-1}\right)\left(1+\frac{1}{2}z^{-1}+\frac{1}{4}z^{-2}\right)}$$ **(06 Marks)**

c. Realize the linear-phase FIR filter having the following impulse response :

$$h(n) = \delta(n) + \frac{1}{4}\delta(n-1) - \frac{1}{8}\delta(n-2) + \frac{1}{4}\delta(n-3) + \delta(n-4)$$ **(06 Marks)**

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06EC53

Fifth Semester B.E. Degree Examination, December 2011
Analog Communication

Time: 3 hrs. Max. Marks:100

Note: ***1. Answer any FIVE full questions, selecting at least TWO questions from each part.***
2. Missing data be suitably assumed.
3. Standard notations are used.
4. Draw neat diagrams, wherever necessary.

PART – A

1 a. Define autocorrelation function of the process X(t). Explain the properties of autocorrelation function. **(06 Marks)**

b. Define Gaussian process. Explain the properties of Gaussian process. **(06 Marks)**

c. Let X be a continuous random variable having a uniform probability distribution defined in the range $2 \le x \le 4$. Let $y = (3x + 2)$. Find the means m_x and m_y. **(08 Marks)**

2 a. Explain with block diagram the coherent detection of conventional AM waves. Explain frequency error and phase error in this method. **(08 Marks)**

b. Explain with block diagrams, quadrature carries multiplexing and demultiplexing systems. **(06 Marks)**

c. An audio frequency signal ($10 \sin 2\pi \times 500\ t$) volts is used to amplitude modulate a carrier of ($50 \sin 2\pi \times 10^5$) volts. Assume modulation index = 0.2. Find the following :
i) Sideband frequencies
ii) Amplitude of each side band frequencies
iii) B.W. required. **(06 Marks)**

3 a. Obtain time domain description of SSB – SC wane. **(08 Marks)**

b. Explain with block diagram a balanced modulator for the generation of DSB-SC. **(06 Marks)**

c. Define Hilbert transform. Obtain Hilbert transform of the following :
i) $x(t) = (\cos 2\pi ft + \sin 2\pi ft)$
ii) $x(t) = e^{-j2\pi ft}$. **(06 Marks)**

4 a. What is frequency division multiplexing in (FDM)? Explain with a block diagram FDM system. **(06 Marks)**

b. Explain with a block diagram, superheterodyne recervier. Mention the merits of superheterodyne receiver over Tuned Radio Frequency receiver (TRF). **(08 Marks)**

c. Write a short note on vestigial side band modulation (USB). **(06 Marks)**

PART – B

5 a. With a neat block diagram, explain direct method of generating FM wave. Discuss how wide band FM (WBFM) can be generated using this method. **(08 Marks)**

b. Compare AM and FM systems. **(06 Marks)**

c. A 93.2 MHz carrier is frequency modulated by a 5 kHz sine wave. The resultant FM signal has a frequency derivation of 40 kHz.
   i) Find the carrier swing of the FM signal.
   ii) What are the highest and lowest frequencies attained by the frequency modulated signal?
   iii) Calculate the modulation index for the wave. **(06 Marks)**

6 a. Explain with circuit diagram and necessary waveform, a FM slope detector. **(08 Marks)**
b. Explain FM demodulation using PLL. **(08 Marks)**
c. Write short notes on nonlinear effects in FM systems. **(04 Marks)**

7 a. What is a thermal noise? List the properties of thermal noise and briefly explain. **(06 Marks)**
b. Define white noise. Plot Power Spectral Density (PSD) and Auto Correlation Function (ACF) of white noise. **(06 Marks)**
c. An amplifier 1 has a noise figure of 9dB and power gain of 15 dB. It is connected in cascade to the other amplifier 2 with noise figure of 20 dB. Calculate the overall noise figure for this cascade connection. **(08 Marks)**

8 a. Obtain the figure of merit of noise in DSB – SC receiver. **(08 Marks)**
b. Write short notes on :
   i) Pre-emphasis
   ii) De-emphasis
   iii) Amplitude limiters in FM system. **(12 Marks)**

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06EC54

Fifth Semester B.E. Degree Examination, December 2011
Microwaves and Radars

Time: 3 hrs. Max. Marks:100

Note: 1. ***Answer any FIVE full questions, selecting at least TWO questions from each part.***
2. Use of Smith chart is permitted.
3. Assume any missing data.

PART – A

1 a. What are standing waves? Draw the standing wave pattern for :
i) Open circuit termination ii) Short circuit termination iii) Matched termination **(06 Marks)**

b. What is distortionless line? State the conditions for a line to be distortionless. **(06 Marks)**

c. The primary line constants of a transmission line per km are specified as R = 42.9 Ω, L = 0.7 mH, G = 2.4 μ℧, C = 0.1 μF. Calculate Z_o, α, β and V_P, if w = 5000 radians/sec. **(08 Marks)**

2 a. Determine the input impedance of 200 Ω line 3/8 wavelength long terminated in a 100 Ω resistance using Smith chart and write procedural steps. **(10 Marks)**

b. Explain the principle and working of Faraday's rotation isolator. **(10 Marks)**

3 a. Explain the application of PIN diode as single switch and as phase shifter. **(10 Marks)**

b. Explain parametric up converter with necessary equations for gain, noise figure and bandwidth. **(10 Marks)**

4 a. For a two port network, explain S parameters and properties of S parameters. **(10 Marks)**

b. Explain RWH theory and modes of operation Gunn diode. **(10 Marks)**

PART – B

5 a. Explain the properties of magic Tee and mention its application. **(10 Marks)**

b. Write the equations for ϵ_{eff} and Z_o for $\frac{w}{h} >> 1$ and $\frac{w}{h} << 1$ for a micro strip line. **(05 Marks)**

c. A micro strip line has the following parameters :
$\epsilon_r = 5.23$, h = 7 mils, t = 2.8 mils, w = 10 mils.
Calculate the characteristic impedance of the line. **(05 Marks)**

6 a. Explain the principle and working of precision type variable attenuator. **(08 Marks)**

b. Explain the following with respect to radar system :
i) Maximum unambiguous range ii) Clutter attenuation
iii) Improvement factor iv) Doppler shift. **(08 Marks)**

c. A target is closing on a radial of a radar with a relative velocity of 200 knotts. Radar transmits with a wavelength of 5cm. Find the Doppler shift of the target. **(04 Marks)**

7 a. What is blind speed? Derive the equation. **(05 Marks)**

b. Explain with a block diagram, the working of a digital MTI processor used in radar system. **(10 Marks)**

c. A pulse radar having pulse width of 5μs and at PRF of 100 Hz, find maximum unambiguous range and range resolution. **(05 Marks)**

8 a. What are filter banks? Explain unmarking of moving target from the moving clutter using filter banks. **(03 Marks)**

b. Explain the spectrum of high p_{rf} airborne radar systems. **(07 Marks)**

c. A CW radar is operating at p_{rf} of 1 kHz and is having wavelength of 2 cm. Find first and second blind speed. **(10 Marks)**

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Fifth Semester B.E. Degree Examination, December 2011

Digital Switching Systems

Time: 3 hrs. Max. Marks:100

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

PART – A

1 a. Explain the hierarchy of a national public switched telecommunication network, with the help of a neat diagram. **(06 Marks)**

b. Explain the operation of four-wire circuit used in the two-way transmission systems and derive the expressions for stability margin 'M'. **(08 Marks)**

c. Describe plesiocheonous digital hierarchy. **(06 Marks)**

2 a. Differentiate circuit switching and message switching. **(06 Marks)**

b. Explain the significance of distribution frames, with the help of a neat diagram. **(08 Marks)**

c. With the help of a neat diagram, explain the basic types of calls that are usually processed through a digital switching systems. **(06 Marks)**

3 a. Derive the expression for second Erlangs distribution starting from the basic principles. **(08 Marks)**

b. A group of 20 trunks provides a GOS pf 0.01 when offered 12E as traffic :
i) How much GOS is improved if one extra is added to the group?
ii) How mach does the GOS deteriorate if one trunk is out of service? **(06 Marks)**

c. Calculate $E_{2N}(A)$ from $E_{1N}(A)$. **(06 Marks)**

4 a. Design a progressive grading system connecting 30 outgoing trunks and having an availability of only 10 switches. Draw the grading diagram. **(08 Marks)**

b. Obtain an expression for minimum number of cross points for a two stage network with incoming trunks greater than outgoing trunks. **(06 Marks)**

c. Find the GOS when a total of 30E is affected to the two-stage switching network and the traffic is evenly distributed over the 10 outgoing routes. **(06 Marks)**

PART – B

5 a. With a neat ketch, explain the operation of a K X M space switch. **(06 Marks)**

b. Compare S-T-S networks and T-S-T networks. **(07 Marks)**

c. Write a note on frame alignment and synchronization networks. **(07 Marks)**

6 a. Explain with the help of a neat diagram, the classification of the digital switching system software. **(08 Marks)**

b. With the help of feature flow diagram, explain call forwarding feature. **(06 Marks)**

c. Explain the concept of call models in the design of telephony systems. **(06 Marks)**

7 a. Describe the various organizational interfaces of a typical DSS control office. **(10 Marks)**

b. Explain with a neat diagram, a strategy for improving software quality. **(10 Marks)**

8 Write short notes on :

a. Generic switch hardware architecture b. Recovery strategy

c. Common characteristics of DSS d. Analysis report for DSS. **(20 Marks)**

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06EC56

Fifth Semester B.E. Degree Examination, December 2011
Fundamental of CMOS VLSI

Time: 3 hrs. Max. Marks:100

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

PART – A

1 a. Explain the nMOS enhancement mode transistor for different conditions of v_{ds}. **(08 Marks)**

b. Describe in detail BiCMOS fabrication in an n-well process. **(08 Marks)**

c. What are the advantages of BiCMOS process over CMOS technology? **(04 Marks)**

2 a. What is body effect? Which parameters are responsible for it? **(08 Marks)**

b. An nMOS transistor is operating in active region with following parameters $V_{GS} = 3.9V$, $V_{th} = 1V$, $\frac{W}{L} = 100$, $\mu_n c_{ox} = 90\ \mu A/r^2$. Find I_D and drain to source resistance. **(05 Marks)**

c. Explain in detail regions of operation and mid-point voltage equation for CMOS inverter. **(07 Marks)**

3 a. List the λ-based design rules for CMOS. **(05 Marks)**

b. Draw the stick diagram for nMOS EX-OR gate. **(07 Marks)**

c. What is transmission gate? And design stick diagram for transmission gate. **(08 Marks)**

4 a. What is clocked CMOS gate? Where it is preferred? **(06 Marks)**

b. Two nMOS inverters are cascaded to drive capacitive load $C_L = 16\ C_g$ as shown in Fig.Q.4(b).Calculate pair delay v_{in} to v_{out} interms of τ. **(06 Marks)**

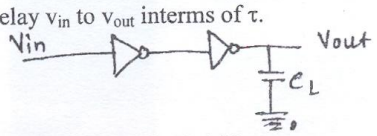

Fig.Q.4(b)

c. Find the scaling factors for MOS circuits :
i) For gate capacitance ; ii) Channel resistance (R_{on})
ii) Saturation current (Id_{ss}) ; iv) Speed power product (PT). **(08 Marks)**

PART – B

5 a. Design bus arbitration logic for n-line bus. **(10 Marks)**

b. Explain two-phase clocking generator using D flip – flops. **(10 Marks)**

6 a. Explain the design steps for 4 bit adder. **(08 Marks)**

b. Draw the basic arrangements of 4 bit serial parallel multiplier. **(08 Marks)**

c. Discuss the timing constraints for system timing considerations. **(04 Marks)**

7 a. For single phase clock define following parameters :
i) Set up time (T_s) ; ii) Hold time (T_h) ; iii) Clock to Q delay (T_q). **(03 Marks)**

b. How to read or write and hold the bit in SRAM cell? **(09 Marks)**

c. Explain the working of 1-transistor DRAM cell. Give the difference between SRAM and DRAM. **(08 Marks)**

8 a. Discuss the meaning of "REAL ESTATE" in VLSI design. **(04 Marks)**

b. What are the different types of I/O pads? **(06 Marks)**

c. List the ground rules for a system design. **(10 Marks)**

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