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06EC52

Fifth Semester B.E. Degree Examination, December 2012
Digital Signal Processing

Time: 3 hrs. Max. Marks:100

Note: 1. *Answer FIVE full questions, selecting at least TWO questions from each part.*
2. *Use of normalized chebyshev and butter worth proto type tables not allowed.*

Important Note : 1. On completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages.
2. Any revealing of identification, appeal to evaluator and /or equations written eg, 42+8 = 50, will be treated as malpractice.

PART – A

1 a. Compute the N-point DFT of the sequence $x(n) = an \; 0 \le n \le N-1$. **(05 Marks)**

b. Compute DFT {x(n)} of the sequence given below using the linearity property, $x(n) = \cosh an \; 0 \le n \le N-1$. **(05 Marks)**

c. If x(n) denotes a finite length sequence of length N. Show that DFT $\{x((-n))_N\} = x((-K))_N$. **(05 Marks)**

d. Find the energy of the 4-point sequence $x(n) = \sin\left(\frac{2\pi}{N}n\right)$, $0 \le n \le 3$. **(05 Marks)**

2 a. Let x(n) be a finite length sequence with $X(K) = (0, 1+j, 1, 1-j)$ using the properties of the DFT, find DFTS of the following sequences:

i) $x_1(n) = e^{j\frac{\pi}{2}n} x(n)$

ii) $x_2(n) = \cos\left(\frac{\pi}{2}n\right) x(n)$

iii) $x_3(n) = x((n-1))_4$

iv) $x_4(n) = (0, 0, 1, 0) \circledast_4 x(n)$ **(10 Marks)**

b. For the DFT pair shown, compute the values of the boxed quantities using appropriate properties:

$(\boxed{X_0}, 3, -4, 0, 2) \xleftrightarrow{DFT} (5, \boxed{X_1}, -1.28\text{-}j3.49, \boxed{X_3}, 8.78\text{-}j1.4)$ **(05 Marks)**

c. Given the finite lengths sequence,
$x(n) = 2\delta(n) + \delta(n-1) + \delta(n-3)$ find the following:
i) 5 point DFT X(K)
ii) 5 point inverse DFT of $Y(K) = X^2(K)$ for n = 0, 1, ….4 **(05 Marks)**

3 a. Develop the DIF FFT algorithm for N = 8. **(10 Marks)**

b. Given $x(n) = \{1, 2, 3, 4, 4, 3, 2, 1\}$, find X(K) using DIT FFT algorithm. **(10 Marks)**

4 a. Consider a FIR filter with impulse response h(n) = {3, 2, 1, 1}. If the input is x(n) = {1, 2, 3, 3, 2, 1, -1, -2, -3, 5, 6, -1, 2, 0, 2, 1}, find the output using overlap add method assuming the length of the block as 7. **(10 Marks)**

b. A designer is having a number of 8-point FFT chips. Show explicitly how he should interconnect three chips in order to compute a 24 point DFT. **(05 Marks)**

c. Develop the Goertzel algorithm for the computation of DFT. **(05 Marks)**

PART – B

5 a. A system function $H_5(s)$ represents a 1 rad/sec fifth-order normalized butter worth filter,
i) Give H5(s) in both the polynomial and factored forms.
ii) What is the gain $|H_5(j\Omega)|$ at $\Omega = 1$ rad/sec? What is the gain in decibels? **(10 Marks)**

b. Determine the transfer function of a normalized butterworth filter of order N = 6. Show the pole locations in the s-plane. **(10 Marks)**

6 a. Explain the frequency sampling method of designing FIR filters and draw the corresponding block diagram. **(10 Marks)**

b. Use the window method with a rectangular window to design a 11 top Hilbert transformer. The magnitude response of an ideal Hilbert transformer is as shown in Fig. Q6 (b). Also, find the following:
i) Transfer function of the FIR Hilbert transformer.
ii) The difference equation realization for the FIR Hilbert transformer, and
iii) Expression for magnitude frequency response. **(10 Marks)**

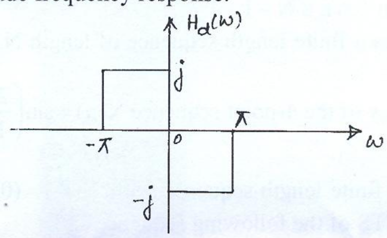

Fig. Q6 (b)

7 a. Design a butterworth filter for the specification given below using bilinear transformation technique:
Pass band frequency = 0.2 π
Pass band attenuation = 1 dB
Stop band frequency = 0.3 π
Stop band attenuation = 15 dB
Assume T = 1 **(14 Marks)**

b. Use Impulse invariance method to design a digital filter from an analog prototype that has a system function,

$$H(s) = \frac{(s+a)}{(s+a)^2 + b^2}, \quad T = 1 \text{ sec}$$ **(06 Marks)**

8 a. A system is specified by its transfer function,

$$H(z) = \frac{(z-1)(z-2)(z+1)z}{\left[z-\left(\frac{1}{2}+j\frac{1}{2}\right)\right]\left[z-\left[\frac{1}{2}-j\frac{1}{2}\right]\right]\left[z-j\frac{1}{4}\right]\left[z+j\frac{1}{4}\right]}$$

Realize the systems in the following forms,
i) Cascade of two biquadratic sections.
ii) A parallel realization in constant, linear and biquadratic sections. **(15 Marks)**

b. Realize the linear phase FIR filter having the following impulse response $h(n) = \delta(n) + \frac{1}{4}\delta(n-1) - \frac{1}{8}\delta(n-2) + \frac{1}{4}\delta(n-3) + \delta(n-4)$. **(05 Marks)**

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Important Note : 1. On completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages.
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Fifth Semester B.E. Degree Examination, December 2012

Analog Communication

Time: 3 hrs. Max. Marks:100

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

PART – A

1 a. Define: i) Random variable ii) Mean iii) Correlation iv) Covariance functions. **(08 Marks)**

b. A random variable has a probability density function

$$f_X(X) = \begin{cases} \frac{5}{4}(1-X^4) & 0 \le X \le 1 \\ 0 & \text{elsewhere} \end{cases}.$$

Find: i) E(X), ii) E [4X + 2], iii) E [X^2] **(06 Marks)**

c. What is Gaussian process? List the properties of Gaussian process. **(06 Marks)**

2 a. Explain the generation of an AM wave using square-law modulator, and show that overall output $V_0(t) = a_1 A_C \left[1 + \frac{2a_2}{a_1} m(t)\right] \cos(2\pi f_C t)$. **(08 Marks)**

b. Consider a message signal m(t) = 20 cos (2πt)V and the carrier wave c(t) = 50 cos (100πt)V.
i) Write an expression for the resulting AM wave for 75% modulation in time domain.
ii) Draw the spectrum of AM wave
iii) Sketch the resulting wave for 75% modulation. **(06 Marks)**

c. Explain the operation of coherent detection of DSB SC modulating wave and show that the overall output $V_0(t) = \frac{1}{2} A_C \cos\phi \, m(t)$. **(06 Marks)**

3 a. With a neat block diagram, explain the generation of SSB wave using phase discrimination method. **(08 Marks)**

b. Consider a two stage modulator shown in Fig.Q3(b). The input signal consists of a voice signal occupying the frequency band 0.3 to 3.4 kHz. The two oscillator frequencies have the values f_1 = 100 kHz and f_2 = 10 MHz. Specify the following:
i) Sidebands of DSB-SC modulated wave appearing at the two product modulator output.
ii) The sidebands of SSB modulated wave appearing at the two BPF outputs.
iii) The pass band and guard bands of the two band pass filters.
iv) Sketch he spectrum of the signal at each stage. [Assume suitable m(f)]

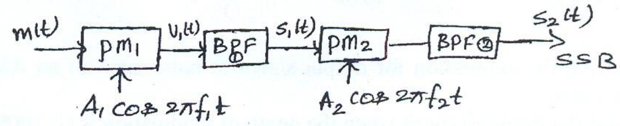

Fig.Q3(b) **(08 Marks)**

c. What is Hilbert transform? Obtain the Hilbert transform of the signal g(t) = sin $2\pi f_C t$. **(04 Marks)**

4 a. What is meant by VSB? Explain how VSB signal can be obtained from a modulating signal m(t) using a carrier $A_C \cos(2\pi f_C t)$ and later demodulated. **(08 Marks)**

b. With a block diagram, explain the operation of FDM transmitter receiver. **(08 Marks)**

c. Compare DSB-FC, DSB-SC, SSB and VSB. **(04 Marks)**

PART – B

5 a. Define angle modulation. Explain how FM wave can be generated using Armstrong (indirect) method. **(08 Marks)**

b. Sketch FM and PM waves for the modulating signal m(t) a shown in Fig.Q5(a). Assume frequency of 100 MHz and constants K_f and K_p as $2\pi \times 10^5$ and $\frac{\pi}{4}$ respectively.

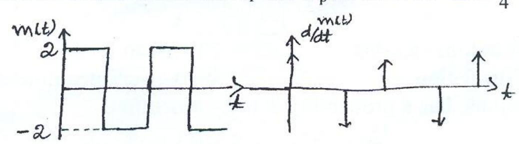

Fig.Q5(a) **(08 Marks)**

c. Compare FM with AM. **(04 Marks)**

6 a. Explain the detection process of FM signal using Foster-Seelay discriminator. **(08 Marks)**

b. What is PLL? Explain the non-linear and linear model of PLL can be used to demodulate an FM wave, with relevant block diagram and expressions. **(12 Marks)**

7 a. Write short notes on:

i) Shot noise

ii) Therma noise **(06 Marks)**

b. Determine the noise equivalent bandwidth for RC low pass filter shown in Fig.Q7(b).

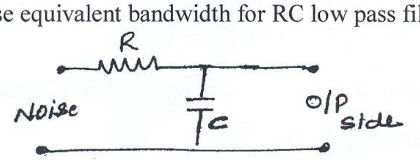

Fig.Q7(b) **(06 Marks)**

c. A TV receiving system is as shown in the Fig.Q7(c). A preamplifier is used to overcome the effect of the lossy cable. Typical values of the parameters are as shown in figure.

i) Find the overall noise figure of the system.

ii) Find the overall noise figure if the preamplifier is omitted.

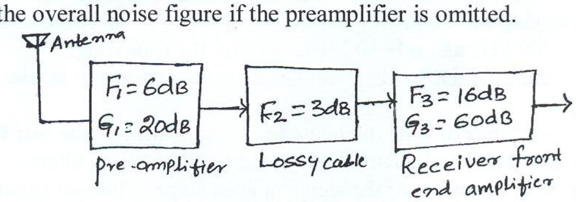

Fig.Q7(c) **(08 Marks)**

8 a. Derive the expression for output signal-to-noise ratio of an AM receiver using an envelop detector. **(10 Marks)**

b. Find the figure of merit when the depth of modulation is (i) 100%, (ii) 50%, (iii) 30%. **(03 Marks)**

c. What is pre-emphasis and de-emphasis? Explain briefly how is it useful in FM. **(07 Marks)**

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Fifth Semester B.E. Degree Examination, December 2012

Microwaves and Radar

Time: 3 hrs. Max. Marks:100

Note: 1. ***Answer FIVE full questions, selecting at least TWO questions from each part.***
2. ***Candidates are allowed to use Smith charts.***

Important Note : 1. On completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages.
2. Any revealing of identification, appeal to evaluator and /or equations written eg, 42+8 = 50, will be treated as malpractice.

PART – A

1 a. Define SWR and reflection co-efficient of a microwave transmission line. **(06 Marks)**

b. The normalized impedance of a microwave transmission line $Z_l = 1 + j1$ and the operating wavelength λ = 5 cm. Using Smith chart determine the first voltage maxima, first voltage minima from the load. Also find VSWR. **(09 Marks)**

c. Describe the single stab matcher. **(05 Marks)**

2 a. Derive TM_{mn} mode characteristic equations in rectangular waveguides. **(10 Marks)**

b. The TE_{10} mode is described as the dominant mode in rectangular waveguides. What property does it have which makes it dominant? **(05 Marks)**

c. What are cavity resonators? What applications do they have? **(05 Marks)**

3 a. Draw the schematic diagram of an IMPATT diode, and explain its operation. **(10 Marks)**

b. A typical n-type GaAs Gunndiode has following parameters:
Threshold field E_{th} = 2800 V/cm
Applied voltage E = 3200 V/cm
Device length L = 10 μm
Doping concentration $n_0 = 2\times10^{14}\,cm^{-3}$
Operating frequency f = 10 GHz
i) Compute the electron drift velocity.
ii) Calculate the current density.
iii) Estimate the negative electron mobility. **(06 Marks)**

c. Briefly explain the operation of PIN diode. **(04 Marks)**

4 a. What are the advantages of [S] matrices over [Z] matrices? **(06 Marks)**

b. List the common properties for [S] and [Z] matrices. **(04 Marks)**

c. Define insertion loss, transmission loss, return loss interms of s-parameters. **(10 Marks)**

PART – B

5 a. With the aid of neat sketch, describe characteristics and s-matrix for Magic – Tee **(10 Marks)**

b. Justify the statement : "An ideal isolator is a non reciprocal transmission device" **(05 Marks)**

c. Briefly explain the operation of phase shifter. **(05 Marks)**

6 a. Obtain the attenuation constants for the conductor and dielectric losses of a parallel strip line. **(06 Marks)**

b. A lossless parallel strip line has a conducting strip width 'W'. The substrate dielectric separately the two conducting strips has a relative dielectric constant E_{rd} of 6 (Beryllium oxide BeO) and thickness of 'd' of 4 mm. Calculate i) The required width W of the conducting strip in order to have a characteristic impedance of 50 Ω. ii) The strip line capacitance. iii) The strip line inductance iv) The phase velocity of the wave in the parallel strip line. **(08 Marks)**

c. What are the advantages of coplanar strip line over conventional parallel strip line? **(06 Marks)**

7 a. Draw the block diagram of a basic radar set and explain the essential of its operation. **(06 Marks)**

b. Derive the basic radar range equation, as governed by the minimum receivable echo power P_{min}. **(10 Marks)**

c. Calculate the maximum range of a radar system which operates at 3 cm. With peak pulse power of 500 kW, if its minimum receivable power is 10^{-13}W , the capture area of its antenna is 5 mt^2 and the radar cross-sectional area of the target is 20 mt^2. **(04 Marks)**

8 a. With the aid of a block diagram, explain fully the operation of an MTI radar system using a power amplifier in the transmitter. **(12 Marks)**

b. What is the Doppler effect? **(04 Marks)**

c. What are the advantages offered by digital MTI processing? **(04 Marks)**

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06EC55

Fifth Semester B.E. Degree Examination, December 2012

Digital Switching Systems

Time: 3 hrs. Max. Marks:100

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

PART – A

1 a. Explain the hierarchy of PSTN with a neat diagram. **(05 Marks)**
b. Briefly explain the channeling equipment for multiplexing with a suitable diagram. **(09 Marks)**
c. Give the need for echo suppressor and define (i) AAR, (ii) PBX, (iii) BRL. **(06 Marks)**

2 a. List the advantages of,
i) Electronic switching system,
ii) Cross point switch over step by step switch. **(06 Marks)**
b. What are the significance of distribution frames? Explain the operation of distribution frames with a neat diagram. **(10 Marks)**
c. Describe the fundamentals of DSS with a neat diagram. **(04 Marks)**

3 a. Derive an expression for a Erlangs delay and queue capacity. **(06 Marks)**
b. During the busy hour a group of trunks is offered 100 calls having an average duration of 3 minutes one of call fails to find a disengaged trunk. Find the traffic offered to the group and the traffic carried by the group. **(06 Marks)**
c. A group of 5 trunks is offered 2E of traffic, find:
i) The GOS
ii) The probability that only one trunk is busy
iii) The probability that only one trunk is free
iv) The probability that atleast one trunk is free. **(04 Marks)**
d. Define: i) GOS ii) CCR iii) BHCA,
iv) Congestion v) Busy hour vi) Peak busy hour. **(04 Marks)**

4 a. A 3-stage fully inter connected switching network is to connect 600 incoming trunks to 100 outgoing trunks. It is to use switches assembled from blocks of size 5×5. Design a suitable network and determine the number of switches blocks required. **(10 Marks)**
b. Explain briefly the meanings of the following terms applied to gradings:
i) Graded groups
ii) Availability
iii) Progressive grading
iv) Skipped grading
v) Homogeneous grading **(05 Marks)**
c. Explain that the step-by-step selection is unsuitable for two stage network, which is the suitable selection and why? **(05 Marks)**

PART – B

5 a. An S-T-S network has 10 incoming and 10 outgoing highways. Each of which conveys 32 PCM channels between incoming and outgoing space switches, there are 20 lines containing time switches. During the busy hour, the network is offered 200 E of traffic and it can be assumed that this is evenly distributed over the outgoing channels. Estimate the grade of service obtained if,
   i) Connection is required to a particular free channel on a selected outgoing highway (mode 1)
   ii) Connection is required to a particular outgoing highway, but any free channel on it may be used (mode 2) **(10 Marks)**

b. With a neat diagram, explain the operation of time switch implementation and bilateral synchronization system. **(10 Marks)**

6 a. Explain the basic software functionality of DSS. **(05 Marks)**

b. Draw the basic software architecture of a typical digital switching system and briefly explain the database management and generic program. **(05 Marks)**

c. Explain the flow diagram for subscriber features and call forwarding. **(10 Marks)**

7 a. Briefly explain the software process matrices and describe the defect analysis with an example. **(10 Marks)**

b. Explain the problem reporting system with a suitable block diagram and briefly explain how the maintenance cost is reduced in DSS. **(10 Marks)**

8 a. Explain generic switch hardware and software architecture with a neat diagram. **(10 Marks)**

b. Write short notes on:
   i) Common characteristic of DSS
   ii) Analysis report. **(10 Marks)**

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Fifth Semester B.E. Degree Examination, December 2012
Fundamentals of CMOS VLSI

Time: 3 hrs. Max. Marks:100

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

PART – A

1 a. Explain with structure the step-by-step flow of n-well fabrication process. **(10 Marks)**
b. Explain the design equations of MOS devices and VI characteristics for n and p devices. **(10 Marks)**

2 a. What are the different MOS layers? Draw the λ based design rules for a transistor. **(07 Marks)**
b. A NMOS transistor has a threshold voltage of 0.75V, the body effect co-efficient equal to 0.54 compute the threshold voltage for $V_{SB} = 5V$ and $2\phi_F = -0.6$ V. **(05 Marks)**
c. Draw the circuit and stick diagram of two input NAND gate using CMOS logic, use standard colour or monochrome codes. **(08 Marks)**

3 a. Explain the Pseudo-NMOS logic, structure and their salient features with example. **(08 Marks)**
b. Explain with the circuit the working principle of Bi-CMOS not gate and show the sub circuits of the output voltage. **(08 Marks)**
c. Implement the complementary CMOS logic, for the expression $Y = \overline{A \cdot (B + C) \cdot (D + E)}$. Show the design step clearly. **(04 Marks)**

4 a. With a neat circuit diagram and waveform, explain the principle of operation of a dynamic logic and what are the advantages and disadvantages. **(10 Marks)**
b. Explain with circuit diagram the super buffers with inverting type and non-inverting type of nmos. **(10 Marks)**

PART – B

5 a. Discuss the architectural issues to be followed in the design of a VLSI subsystems. **(10 Marks)**
b. Design a 4:1 multiplexer using nmos logic and CMOS logic. **(10 Marks)**

6 a. Explain the important general consideration in CMOS design process. **(07 Marks)**
b. Explain the implementation of ALU functions with a standard adder. **(08 Marks)**
c. Define regularity in process illustration. **(05 Marks)**

7 a. Discuss the important factors of system timing consideration. **(10 Marks)**
b. Draw the circuit and stick diagram. Explain n-MOS pseudo-static memory cell. **(10 Marks)**

8 Write short notes on :
a. I/O Pads
b. Test and testability
c. LSSD
d. BIST **(20 Marks)**

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