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06EC52

Fifth Semester B.E. Degree Examination, June 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 filter tables not permitted.***

PART – A

1 a. Consider the finite length sequence $x[n] = \delta[n] + 2\delta[n-5]$. Find:
   i) The 10 point DFT of x[n]
   ii) The sequence that has a DFT, $Y(K) = e^{\frac{-j4\pi K}{10}} X(K)$ where X(K) is the 10 point DFT of x[n]
   iii) Find the 10 point sequence y[n] that has a DFT Y(K) = X(K)W(K) where X(K) is the 10 point DFT of x[n] and W(K) is the 10 point DFT of u[n] – u[n – 7]. **(15 Marks)**

   b. Find the N point DFT of the sequence,

$$x[n] = 4 + \left\{\cos^2 \frac{2\pi n}{N}\right\} \qquad 0 \le n \le (N-1)$$ **(05 Marks)**

2 a. Determine the circular convolution of the sequence x[n] = {2, 1, 2, 1} and h[n] = {1, 2, 3, 4} using DFT and IDFT equations. **(08 Marks)**

   b. Determine the response of a LTI system with h[n] = {1, -1, 2} for an input x[n] = {1, 0, 1, -2, 1, 2, 3, -1, 0, 2} using overlap. Add method and 6 point circular convolution. **(12 Marks)**

3 a. What are the two properties of phase factor W_N that are exploited in fast Fourier transform algorithm? Prove them. **(04 Marks)**

   b. Derive the Radix 2 decimation in time FFT algorithm to compute the DFT of a N = 8 point sequence and draw the final complete signal flow graph. **(10 Marks)**

   c. Let x[n] be a finite length sequence with X(K) = {0, 1+j, 1, 1–j}. Using the properties of the DFT find the DFTs of the following sequences:

$$\text{i) } x_1[n] = e^{\frac{j\pi n}{2}} x[n] \qquad \text{ii) } x_2[n] = \cos\left(\frac{\pi}{2}n\right) x[n] \qquad \text{iii) } x_3[n] = x\{(n-1)_4\}$$ **(06 Marks)**

4 a. Find the DFT of the sequence x[n] = {1, , 3, 4, 4, 3, 2, 1} using the decimation in time FFT algorithm and draw the signal flow graph. **(10 Marks)**

   b. Given x[n] = {1, 0, 1, 0}, find X(2) using Goertzel algorithm. **(05 Marks)**

   c. Write a note on Chirp Z transform algorithm. **(05 Marks)**

PART – B

5 a. Given that $|Ha(j\Omega)|^2 = \frac{1}{1+16\Omega^4}$, determine the analog filter system function Ha(s). **(08 Marks)**

   b. Compare Butterworth and Chebyshev filters. **(04 Marks)**

   c. Design an analog lowpass Butterworth filter that has a -2 dB or better cut off frequency of 20 rad/sec and atleast 10 dB attenuation at 30 rad/sec. **(08 Marks)**

6 a. Design a FIR lowpass filter with a desired frequency response

$$Hd(e^{jw}) = \begin{cases} e^{-j3w}, & -\frac{3\pi}{4} \le w \le \frac{3\pi}{4} \\ 0, & \frac{3\pi}{4} \le |w| \le \pi \end{cases}.$$

Use Hamming window with M = 7. **(10 Marks)**

b. Using frequency sampling method, design a band pass filter with the following specifications. Determine the filter coefficients for N = 7, sampling frequency, F = 8000 Hz, cut off frequencies fc_1 = 1000 Hz, fc_2 = 3000 Hz. **(10 Marks)**

7 a. Design a digital lowpass filter using the bilinear transformation method to satisfy the following characteristics:

i) Monotonic stopband and passband
ii) -3dB cut off frequency of 0.5 π rad
iii) Magnitude down atleast 15 dB at 0.75 π rad. **(10 Marks)**

b. Transform the analog filter $H(s) = \frac{(s+0.1)^2}{(s+0.1)^2+9}$ to H(z) using the impulse invariance transformation. **(04 Marks)**

c. Determine the order of a Chebyshev digital lowpass filter to meet the following specifications:
In the passband extending from 0 to 0.25π, a ripple of not more than 2 dB is allowed. In the stopband extending from 0.4π to π, attenuation can be more than 40 dB. Use bilinear transformation method. **(06 Marks)**

8 a. Obtain the direct form II (Canonic) and cascade realization of

$$H(z) = \frac{(z-1)(z^2+5z+6)(z-3)}{(z^2+6z+5)(z^2-6z+8)}.$$

The cascade section should consist of two biquadratic sections. **(10 Marks)**

b. A FIR filter is given by $y[n] = x[n] + \frac{2}{5}x[n-1] + \frac{3}{4}x[n-2] + \frac{1}{3}x[n-3]$. Draw the direct form I and lattice structure. **(10 Marks)**

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06EC53

Fifth Semester B.E. Degree Examination, June 2012
Analog Communication

Time: 3 hrs. Max. Marks:100

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

PART – A

1 a. Define mean, correlation and covariance functions of a random process x(t). **(06 Marks)**

b. Explain the properties of cross correlation function of two wide–sense stationary process x(t) and y(t). **(08 Marks)**

c. 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)**

2 a. Explain the envelope detection of AM wave, using relevant waveforms and equations. **(07 Marks)**

b. Explain the generation of DSB-SC wave, using balanced –modulator. **(07 Marks)**

c. A sinusoidal carrier is amplitude modulated by a square wave that has zero DC component and peak – to – peak value of 2V. The period of the square wave is 0.5 rms. The carrier amplitude is 2.5 V and carrier frequency is 10 KHz. Find the modulation index for the modulated wave. Sketch the modulating, carrier and modulated signals. **(06 Marks)**

3 a. With neat block diagram, write a note on quadrature carrier multiplexing. **(08 Marks)**

b. The output voltage of a transmitter is given by 300 (1 + 0.3 sin 5210 t) sin 2.14×10^7 t. This voltage is fed to a load of 500 Ω resistance. Determine :
i) Carrier frequency
ii) Modulating frequency
iii) Total power output
iv) Carrier power. **(06 Marks)**

c. With frequency spectrum and equations, generate SSBSC wave by using (USB) phase shift method. **(06 Marks)**

4 a. By using time – domain description, derive the equation for the generation of VSB-SC wave. **(06 Marks)**

b. With neat waveforms, explain the concept of up-conversion and down – conversion, using frequency translation. **(08 Marks)**

c. Explain the operation of super – hetero – dyne receiver, with block diagram. **(06 Marks)**

PART – B

5 a. Mention the merits and de – merits of FM system. **(06 Marks)**

b. Explain the generation of FM, using VCO method. **(08 Marks)**

c. The sinusoidal modulating wave $m(t) = A_m \cos w_m t$ is applied to a phase modulators with phase sensitivity kp. The un-modulated carrier wave has a frequency f_C and amplitude A_C. Determine the spectrum of the resulting phase modulated wave assuming that maximum phase deviation $\beta = kp\ A_m$ does not exceed 0.3 radian. **(06 Marks)**

6 a. Explain the detection of FM, using zero – closing technique with necessary waveforms at each stage. **(10 Marks)**

b. With neat block diagram, explain FM stereo – multiplexing. **(10 Marks)**

7 a. Define different types of internal noise with noise equations. **(06 Marks)**

b. Explain noise factors of amplifier in cascade. **(10 Marks)**

c. Calculate the equivalent input noise of an amplifier, having a noise figure of 13 dB and has a bandwidth of 2 MHz. **(04 Marks)**

8 a. Derive the figure of merit of AM receiver and show that its equal to

$$\frac{\mu^2}{2+\mu^2}.$$ **(10 Marks)**

b. Explain the concept of pre-emphasis and de-emphasis in an FM system. **(06 Marks)**

c. The carrier reaching an envelope detector in an AM receiver has an RMS value equal to 1 volt in the absence of modulation. The noise at the input of the envelope detective has a PSD equal to 10^{-3} watts/ Hz. If the carrier is modulated to a depth of 100% and message bandwidth = 3.2 KHz, find $[SWR]_0$. **(04 Marks)**

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06EC54

Fifth Semester B.E. Degree Examination, June 2012
Microwaves and Radar

Time: 3 hrs. Max. Marks:100

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

PART - A

1 a. Derive an expression for the line impedance Z, at point P, at a distance 'd' from the receiving end interms of Z_L and Z_O. **(08 Marks)**

b. Define and derive expression for reflection coefficient and transmission coefficient for a transmission line. **(06 Marks)**

c. A generator of 1volt, 1kHz supplies power to 100km long line terminated Z_o. The parameters of the line are R = 10.4Ω/km , L = 0.00367H/km , G = 0.8×10^{-6} ℧/km and C = 0.00835×10^{-6} F/km. Calculate Z_o, attenuation constant and phase constant. **(06 Marks)**

2 a. Derive the wave equation for a TM wave and obtain all field components in a rectangular wave guide. **(10 Marks)**

b. Determine the cut off wave length for the dominant mode in a rectangular wave guide of breadth 10cm. A signal of frequency 2.5 GHz is being propagated in the waveguide in the dominant mode. Calculate the guide wave length group velocity and phase velocity. **(04 Marks)**

c. Explain the construction, working and applications of Isolator based on Faraday's rotation. **(06 Marks)**

3 a. Explain the principle of operation of Read diode, with suitable diagrams. **(06 Marks)**

b. Draw the equivalent circuit diagram for parametric amplifier and explain. **(05 Marks)**

c. Derive the expression for the power output and efficiency of IMPATT diode. **(05 Marks)**

d. A gunn oscillator has the following parameters associated with it :
Threshold electric field E_{th} = 250 KV/m ; Applied electric field E = 300 KV/m ;
Device length L = 12μm ; Doping concentration $n_o = n = 1 \times 10^{15}$ cm^3 ;
Operating frequency f = 15 GHz. Compute i) Electron drift velocity ii) Current density iii) Negative electron mobility. **(04 Marks)**

4 a. State and prove the following properties of scattering parameters :
i) Symmetry property ii) Unitary property iii) Zero property
iv) Phase shifting property. **(10 Marks)**

b. Explain the relation between incident and reflected waves interms of scattering parameters for a 2 – port network. Also explain the physical significance of S – parameters. **(06 Marks)**

c. Two transmission lines of characteristic impedance Z_1 and Z_2 are joined at plane PP^1. Explain S parameters interms of impedances. **(04 Marks)**

PART - B

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

b. Explain magic tee and its applications. **(08 Marks)**

c. What are the applications of radar? **(05 Marks)**

6 a. Explain the construction and field pattern for micro strip line. **(08 Marks)**

b. Compare strip line with micro strip line. **(04 Marks)**

c. A strip (shielded strip line) has the following parameters :
Dielectric constant of insulator $t_r = 2.56$; Strip width w = 63.5mm
Strip thickness t = 35mm ; Shield depth d = 180mm. **(08 Marks)**
Compute i) Characteristic impedance ii) K factor iii) Fringe capacitance.

7 a. Derive the radar range equation. Discuss the effects of each parameter on the maximum detection range of the radar. **(10 Marks)**

b. A radar operating at 1.5 GHz uses a peak pulse power of 2.5 MW and has a range of 100nmi for objects, whose radar cross section is $1m^2$. If the minimum receivable power of the receiver is 2×10^{-13}w, what is the smallest diameter of the antenna reflector, assuming it to be a full paraboloid with an aperture efficiency of 0.65. **(10 Marks)**

8 a. Explain the principle and working of MTI radar, with the help of a block diagram. **(10 Marks)**

b. Write brief notes on :
i) Blind speed ii) Delay line canceller. **(10 Marks)**

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06EC55

Fifth Semester B.E. Degree Examination, June 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 briefly with neat diagram, national telecommunication network. **(06 Marks)**
b. With suitable diagram, explain principle of frequency division multiplexing. **(06 Marks)**
c. With neat sketch, explain synchronous digital hierarchy (SDH) with frame structures. **(08 Marks)**

2 a. Bring out salient features of basic functions of switching system. **(06 Marks)**
b. Explain the functions of MDF, IDF and TDF in strowger exchange. **(08 Marks)**
c. Explain neatly, with diagram, the evolution of digital switching system. **(06 Marks)**

3 a. On an average one call arrives every five seconds during a period of 10 seconds, what is the probability that
i) No call arrives; ii) One call arrives; iii) Two calls arrive; iv) More than two calls arrive, where $\mu = 2$. **(08 Marks)**
b. Derive an expression for the second Erlang distribution. **(08 Marks)**
c. Explain the following: i) Pure chance traffic; ii) Congestion. **(04 Marks)**

4 a. Explain briefly the meanings of following terms:
i) Graded groups; ii) Availability;
iii) Skipped grading; iv) Homogeneous grading. **(08 Marks)**
b. With the aid of simple diagram derive expression for progressive grading. **(06 Marks)**
c. Design a two stage switching network for connecting 200 incoming trunks to 200 outgoing trunks. **(06 Marks)**

PART – B

5 a. With neat sketch, explain T-S-T switching network. **(06 Marks)**
b. A T-S-T network has 20 incoming and 20 outgoing PCM highways, each conveying 30 channels, the required grade of service is 0.01, find the traffic capacity of the network if
i) Connection is required to a particular free channel on selected outgoing highway.
ii) Connection is required to the particular outgoing highway but any free channel on it may be used. **(08 Marks)**
c. Explain the frame alignment of PCM signals in digital exchange. **(06 Marks)**

6 a. Explain in brief digital switching system software classification. **(10 Marks)**
b. With neat block diagram, explain software linkages during a call. **(10 Marks)**

7 a. Explain briefly with neat block diagram of organizational interfaces of a typical digital switching systems central office. **(10 Marks)**
b. Explain system outage and its impact on digital switching system reliability. **(04 Marks)**
c. Write a short note on defect analysis. **(06 Marks)**

8 a. Explain A generic switch software architecture. **(10 Marks)**
b. Explain three level scheme of recovery strategy in digital switch. **(06 Marks)**
c. Write common characteristics of digital switching system. **(04 Marks)**

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06EC56

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

Time: 3 hrs. Max. Marks:100

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

PART – A

1 a. Explain the nMOS fabrication process, with neat diagram. **(10 Marks)**

b. Explain the influence of β_n/β_p on the DC transfer characteristics of inverter. **(05 Marks)**

c. Discuss the difference in the thermal sequence between nMOS and CMOS processes. **(05 Marks)**

2 a. Draw the circuit schematic and stick diagram for CMOS 2 input NOR gate. **(07 Marks)**

b. With neat sketches, explain λ based design rules for pMOS, nMOS and nMOS depletion mode transistor. **(06 Marks)**

c. List the colour, stick encoding, mask layout encoding, layers for a simple metal nMOS process. **(07 Marks)**

3 a. Explain the operation of CMOS dynamic logic. Discuss the merits and demerits. **(06 Marks)**

b. Realize $Z = \overline{A(B+C)+DE}$ for a clocked CMOS logic. **(06 Marks)**

c. What are the properties of nMOS and pMOS switches? How is transmission gate useful? **(08 Marks)**

4 a. What are the scaling factors of
i) Parasitic capacitance C_X
ii) Power dissipation per unit area P_a. **(04 Marks)**

b. Calculate the ON resistance for nMOS inverter with $R_{sn} = 10\ K\Omega$, $Z_{PU} = 8$ and $Z_{pd} = 1$. **(04 Marks)**

c. What are the possible effects of propagation delay in cascaded pass transistor chain and long polysilicon wires? **(12 Marks)**

PART – B

5 a. Explain how to implement the switch logic of four way multiplexer, using transmission gate. **(10 Marks)**

b. Explain the dynamic 4-bit shift register, using nMOs logic. **(10 Marks)**

6 a. Discuss the problems associated in VLSI design. **(04 Marks)**

b. Explain the design steps for a 4-bit adder. **(06 Marks)**

c. Explain 4-bit Braun multiplier, with net diagram. **(10 Marks)**

7 a. Explain the working of one transistor dynamic memory cell, with schematic and stick diagram. **(06 Marks)**

b. Explain nMOS pseudo static memory cell, with stick diagram. **(08 Marks)**

c. Explain the concept of system partitioning in VLSI chip testing. **(06 Marks)**

8 Write short notes on :
a. BICMOS logic
b. CMOS inverter noise margin
c. Built in self test (BIST)
d. Input/output pads. **(20 Marks)**

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