B.E. Extc Sem VII (R) 26-5-2010
Discrete Time Signal Prossing

Con. 3306-10. **AN-2854**

(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 any data wherever **required** but justify the same.
(4) **Figures** to the **right** indicate **full** marks.

1. (a) Sketch the pole-zero plot for the system with transfer function **5**

$$H(z) = \frac{z^6 - 2^6}{z^5 (z-2)}$$ if the system is stable.

(b) One of the zeros of a causal linear phase FIR filter is at $0{\cdot}5\, e^{j\pi/3}$. Show the locations of the other zeros and hence find the transfer function and impulse response of the filter. **5**

(c) Derive the relationship between DFT and DCT. **5**

(d) Find the convolution of the following signals and system transfer function using Z-transform. **5**

$$x[n] = \delta[n] + \delta[n-1] \quad \text{and} \quad h[n] = \left(\tfrac{1}{2}\right)^n u(n).$$

2. (a) Using DIF FFT, find DFT of following sequence **10**
$x[n] = \{ 1, 3, -2, 4, 1, -2, +3 \}$

(b) (i) Using results in Q2(a) find $X_2(k)$ if **5**
$x_2[n] = x[n-2]$

(ii) Using results in Q2(a) find $X_3(k)$ if **5**
$x_3[n] = x^*[n]$.

3. (a) Design a digital Butterworth low pass filter satisfying the following specifications using bilinear transformation (Assume T = 1 sec) **10**

$$0{\cdot}9 \le |H(e^{jw})| \le 1 \quad ; \quad 0 \le w \le \pi/2$$

$$|H(e^{jw})| \le 0{\cdot}2 \quad ; \quad \frac{3\pi}{4} \le w \le \pi$$

(b) Derive and draw the FFT for N = 6 = 2·3 using DIT FFT method. **10**

4. (a) Determine the filter coefficients h[n] for the desired frequency response of a low pass filter **10**

$$H_d\left(e^{jw}\right) = \begin{cases} e^{-j2w} & ; \ -\pi/4 \le w \le \dfrac{\pi}{4} \\ 0 & ; \ \pi/4 \le |w| \le \pi \end{cases}$$

Use Hamming window.

(b) The difference equation of the system is given by : **10**

$y[n] = 3y[n-2] + 2y[n-1] + x[n]$ and

$$x[n] = \left(\frac{1}{2}\right)^n u[n] \text{ with } y(-1) = y(-2) = 1$$

Determine :
(i) Zero input response
(ii) Zero state response
(iii) Total response.

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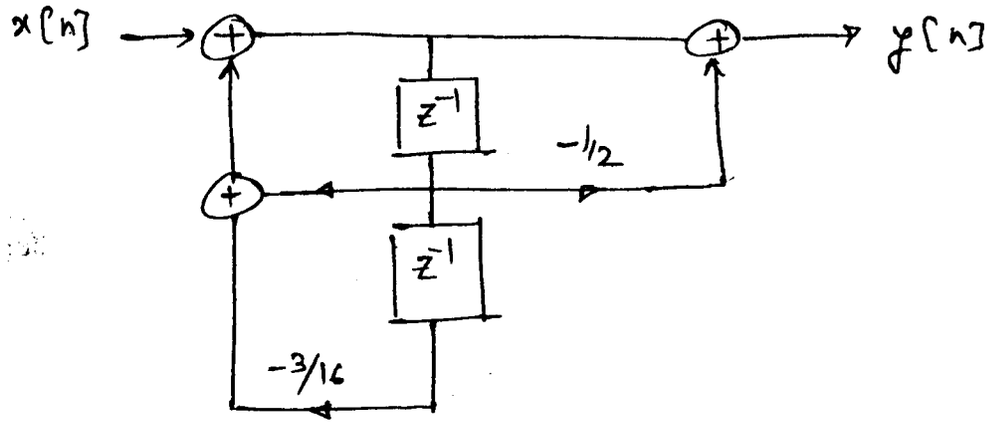
5. (a) For direct form-II realization of IIR filter, find : **12**
   (i) Transfer function of the filter
   (ii) Difference equation
   (iii) Impulse response of the filter
   (iv) Step response of the filter
   (v) Pole-zero plot of the filter
   (vi) State whether filter is stable or Not and Why ?



   (b) Convert the analog filter into digital filter by using impulse invariance transformation method **8**

$$H_a(s) = \frac{s+0\cdot4}{(s+0\cdot4)^2+9}$$

6. (a) With the help of block diagram, explain TMS 320 (5x series of processors). **10**
   (b) Design a digital resonator with a peak gain of unity at 50 Hz and 3 dB bandwidth of 6 Hz assuming a sampling frequency of 300 Hz. **10**

7. Write short notes on :— **20**
   (a) Filtering of long data sequences
   (b) Geortzel Algorithm
   (c) Frequency wrapping
   (d) Coefficient Quantization in IIR filter.

Sem VII Rev / E+TC

5-6-2010

15 : 1st half-Exm.10-Mina-(e)

Con. 3115-10.

M.D.&C

AN-2857

(3 Hours) [Total Marks : 100

Microwave Devices & Circuits

N.B. (1) Question No. **1** is **compulsory**.
(2) Attempt any **four** questions out of remaining.
(3) **Assume** suitable data wherever **necessary**.
(4) Attach **Smith Chart**.

1. Explain in brief any **four** of the following :— **20**
   (a) Microwave Diodes
   (b) Faraday Rotation in Ferrites
   (c) Co-axial re-entrant cavity
   (d) Slow wave structures
   (e) Limitations of Microwaves.

2. (a) Explain the working of two hole directional coupler with neat diagram and derive it's S-matrix. **20**
   (b) A lossless transmission line with a characteristics impedance of 500 ohms is excited by a signal of voltage $10 \angle 0°$ volts at 1·2 MHz. If the line is terminated by Z_l at a 1 km distance, calculate :
      (i) Input impedance of the line for $Z_l = \infty$ and 0,
      (ii) The voltage at the midpoint of the line for $Z_l = Z_0$.

3. (a) For WR-90, find the cut off wavelength and cut off frequency. **20**
   (b) Explain why waveguide cann't support TEM mode.
   (c) Represent electric and magnetic field distribution in rectangular waveguide operating in TE_{10} and TE_{20} mode using schematic diagram.
   (d) What is waveguide excitation ? Explain following excitation techniques :—
      (i) Electric Excitation
      (ii) Magnetic Excitation.

4. (a) Why S-parameters are used at microwave frequencies ? List and explain properties of S-parameters matrix. **20**
   (b) A TWT operates under the following parameters :
      Beam Voltage V_0 = 3 kV
      Beam Current I_0 = 30 mA
      Charact. impedance of helix $Z_0 = 10\ \Omega$
      Circuit length N = 50
      Frequency (f) = 10 GHz.
      Determine :—
      (i) the gain parameter
      (ii) the output power gain A_p in decibels
      (iii) the propagation constant.

5. (a) A lossless 50 ohms air-filled co-axial line has V_{max} = 2·5 V and V_{min} = 1V when terminated with an unknown load. The distance between the successive voltage minima is 5 cm and the first voltage minimum from the load end is 1·25 cm. Design a short circuit single stub for impedance matching. **20**

(b) What is velocity modulation in a Reflex Klystron ? Explain with suitable equations.

6. (a) Explain the working of a phase-shifter with the help of a neat diagram. **20**

(b) Explain operation of Gunn diode using two valley model and different modes.

7. (a) Explain the dielectric measurement with the help of test bench. **20**

(b) Explain any one application of microwave heating in detail.

(c) Write advantages and applications of microstrip line.

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M.C.S.

Con. 3105–10. AN–2860

(3 Hours) [Total Marks : 100

Mobile Communication Systems

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

1. (a) If the radius of each microcell is made half that of the original cell; then by how much dB should the transmit power be reduced. (n = path loss exponent = 4). **5**
(b) What are the factors influencing small-scale fading. **5**
(c) Explain interleaving used in GSM. **5**
(d) Summarize DECT radio specifications. **5**

2. (a) With a neat block diagram, explain reverse CDMA channel. **10**
(b) With a neat diagram, explain frame structure for GSM. **10**

3. (a) How does microcell zone concept solve the problem of increased number of hand offs in sectoring approach and yet increase capacity. **10**
(b) A hexagonal cell within a 4 cell system has a radius of 1·387 km. A total of 60 channels are used within the entire system. If the load per user is 0·029 Erlangs, and h = 1 call/hour, compute the following for an Erlang C system that has a 5% probability of a delayed call : **10**
(i) How many users per square kilometer will this system support ?
(ii) What is the probability that a delayed call will have to wait for more than 10s ?
(iii) What is the probability that a call will be delayed for more than 10 seconds ?
[From Frlang C chart, for 5% probability of delay with C = 15, traffic intersity = 9 Erlangs].

4. (a) Explain the kinife-edge diffraction model. **10**
(b) Explain the effects of fading due to moltipath time delay spread. **10**

5. (a) Discuss IMT 2000 system. **10**
(b) List the features of Global Star Mobile satellite system and explain the network architecture for Global Star System. **10**

6. (a) How is call handled in AMPS. **10**
(b) Explain the CT2 standard. **10**

7. Write notes on :– **20**

(a) Iridium System

(b) RAKE Receiver in CDMA System

(c) Subscriber Identity Module

(d) Umbrella Cell Approach.

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Con. 3452-10. D.C.E. AN-2875

(4 Hours) [Total Marks : 100

Data Compression & Encryption

N.B.: 1. **Question Number One Is Compulsory**

2. **Attempt Any Four Questions Out of Remaining Six Questions**

1. (a) Compare lossy and lossless compression techniques with suitable examples. 5

(b) What are uniquely decodable codes? What are the tests performed to determine them. 5

(c) Compare the Arithmetic and Huffman coding. 5

(d) What are the main features of digital signature? 5

2. Consider a discrete memoryless source with probability {0.35, 0.25, 0.20, 0.15, 0.05 } 20

Determine :

i) Huffman code for this source

ii) Huffman code by minimum variance method

iii) Determine average length , entropy and efficiency

iv) Draw binary root tree for both the codes.

3. (a) a) With S = {m , n , o , p } and p = { 0.4 , 0.3 , 0.1 , 0.2 } encode message m n n o p using arithmetic Code. Generate tag for encoding and also decipher the tag to decode the sequence back. 10

(b) Why is DCT more popular for image compression? Discuss its usage in JPEG. 10

4. (a) Describe various standards of MPEG audio and video compressions. 10

(b) Explain the role played by KDC in symmetric encryption. 10

5. (a) Explain the working of DES with block diagram. 10

(b) Explain Hash and MAC codes used for authentication. 10

6. (a) Explain RSA algorithm with appropriate example. 10

(b) Explain various key management techniques. 10

7. Write short notes on any two: 20

(a) Chinese remainder theorem.

(b) Run Length Coding.

(c) A law and μ law of companding.

(d) Text compression using PPM method.

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D. C.

Con. 3118-10. Digital Communication **AN-2758**

(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 wherever **necessary** and justify the **same**.

1. Answer the following questions (any **four**) :— **20**
   (a) Define code rate, code efficiency and Hamming distance.
   (b) Using duo-binary encoding how is the bandwidth requirement reduced by half.
   (c) What is matched filter ? How it differs from optimum filter ?
   (d) Determine the bandwidth required for M-ary PSK system. Draw the geometrical representation of M-ary PSk and find the distance between signal point.
   (e) Define and explain ISI and ICI.

2. (a) Find capacity of Gaussian channel of bandwidth 4 KHz with noise PSD 10^{-9} W/Hz. when signal energy is (i) 0·1 J and (ii) 0·001J (iii) How does channel capacity change in (ii) if bandwidth is increased to 10 KHz. **6**
   (b) Five source messages are probable to appear as $m_1 = 0{\cdot}4$, $m_2 = 0{\cdot}15$, $m_3 = 0{\cdot}15$, $m_4 = 0{\cdot}15$, $m_5 = 0{\cdot}15$. Find the coding efficiency for (i) Shannon-Fano coding (ii) Huffman coding. **10**
   (c) An analog signal is bandlimited to B Hz sampled at the Nyquist rate and samples are quantized into 4 levels. The quantization levels Q_1, Q_2, Q_3 and Q_4 (messages) are assumed independent and occur with probabilities $P_1 = P_4 = \frac{1}{8}$ and $P_2 = P_3 = \frac{3}{8}$. Find the information rate of the source. **4**

3. (a) The parity check matrix $\overline{H}$ of a linear (7, 4) block code is given as follows : **8**

$$\overline{H} = \begin{bmatrix} 1 & 0 & 1 & 1 & 1 & 0 & 0 \\ 1 & 1 & 0 & 1 & 0 & 1 & 0 \\ 0 & 1 & 1 & 1 & 0 & 0 & 1 \end{bmatrix}$$

   (i) Find the generator matrix G.
   (ii) Show how data words (1) 0011 (2) 0100 and (3) 0101 are coded.
   (iii) How many errors can be detected and corrected ?
   (iv) Show how error is detected when 2nd bit is detected erroneously for data word 0011.

   (b) For the K = 4, $\frac{1}{3}$ rate convolution encoder, the outputs are given as : **12**

$$v_1 = s_1$$

$$v_2 = s_1 \oplus s_2 \oplus s_3 \oplus s_4$$

$$v_3 = s_1 \oplus s_3 \oplus s_4$$

   (i) Draw the block diagram of encoder.
   (ii) Draw code tree for the same.
   (iii) If the input bit stream to the encoder is given by the 5 bit sequence 10110; Find the coded output bit stream.

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4. (a) Show that duobinary signalling suffers from error propagation while precoded duobinary signalling does not. Explain with encoder and decoder block diagrams and decoding logic. **10**

   (b) Derive an expression for the probability of error of an integrate and dump receiver. **10**

5. (a) Draw the block diagram of MSK transmitter. Why MSK is called shaped QPSK ? **10**

   (b) Differentiate between : **10**

   (i) BPSK and BFSK

   (ii) Coherent and non-coherent code detection.

6. (a) Prove that for the 16-ary QASK digital modulation technique, the Euclidian distance is given by $d = 2\sqrt{0 \cdot 4E_b}$ where E_b = normalised energy per bit, also write the advantages and applications of QASK. **10**

   (b) Compare offset QPSK and Non offset QPSK. **10**

7. (a) With the help of neat block diagram explain DS-SS. How chip duration is related to measurement accuracy in ranging by DS spread spectrum ? **10**

   (b) Explain the basic principle of frequency hop spread spectrum. Explain with waveforms slow frequency hopping and fast frequency hopping. **10**

(Library) Sem-VII/Rev/Extc 16/6/2010
Radar Engg.

P4–Exam.–March–10–2–236

Con. 3168–10. **AN–2869**

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

N.B. : (1) Question No. **1** is **compulsory**.
(2) Attempt any **four** questions out of remaining **six** questions.

1. (a) Explain Radar resolution cell in brief. **20**
   (b) An MTI radar operates at 5 GHz and uses prf of 800 pps. Calculate the lowest three blind speeds of the radar.
   (c) What is the peak power of a radar whose average transmitted power is 200 W, pulse width of, μ sec and prf of 1000 Hz.
   (d) Certain air born radar has peak power P_t = 10 kW and uses 2 PRF's ; fr_1 = 10 KHz, fr_2 = 30 KHz. What are the required pulse width for each PRF so that average transmitted power is contant and is equal to 1500 watts ? Compute pulse energy in each case.

2. (a) Derive an expression for doppler frequency shift in terms of transmitted frequency and radial component of target velocity vector. **10**
   (b) Show that if the separation between the transmitter and the target is less than $\lambda/2$. Then it is possible to determine the range of the target by measuring the relative phase of the signal w.v.t. the transmitted signal of CW Radar. **10**

3. (a) Explain the method for the integration of radar pulses to improve detection. Define the term integration improvement factor. How does this factor affect the radar range equation. **10**
   (b) Describe the chief characteristics of the radar echo from a target when it radar cross-section is in the (i) Rayleigh region (ii) Resonance region and (iii) In the optical region. **10**

4. (a) Describe in detail the principle of working of multifrequency CW Radar. **10**
   (b) With a suitable block diagram explain the working of a conical scan tracking radar. Explain the various factors that need to be considered in determining the optimum sequent angle. **10**

5. (a) Draw the functional block diagram of an MTI radar system and explain its operation. Define the terms range tracking and MTI improvement factor. **10**
   (b) What do you mean by RCS fluctuations ? Explain different swerlings model for RCS fluctuations. **10**

6. (a) What is the purpose of Instrument Landing System (ILS) ? Explain the limitations of ILS and how the same have been overcome in MLS. **10**
   (b) Explain the principle of operation of LORAN A and LORAN C. **10**

7. Write short notes :– **20**
   (a) Phased array radar
   (b) Matched Filter receiver
   (c) VHF Omnirange (VOR)
   (d) Loop antenna as radio direction finder.