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06EC61

Sixth Semester B.E. Degree Examination, June-July 2009
Digital Communication

Time: 3 hrs. Max. Marks:100

Note:1. ***Answer any FIVE full questions, selecting at least TWO questions from each Part A and Part B.***
2. Missing data may be suitably assumed.

PART – A

1 a. Obtain an expression for Fourier Transform of a sampled signal. Assume flat top sampling. **(08 Marks)**

b. A bandpass signal g(t) with a spectrum shown below figure Q1 (b) is ideally sampled. Sketch the spectrum of sampled signals at $f_s = 25$ and 45 Hz. Indicate if and how the signal can be recovered. **(08 Marks)**

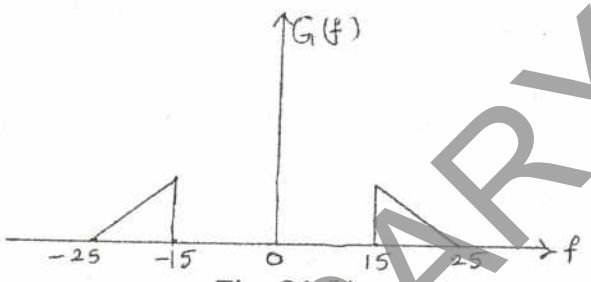

Fig. Q1 (b)

c. What is 'aperture effect'? How is it eliminated? **(04 Marks)**

2 a. Explain the need for nonuniform quantization. Also explain μ-law and A-law companding. **(08 Marks)**

b. If E denotes the energy of a strictly bandlimited signal g(t), then prove that $E = \frac{1}{2\omega}\sum_{n=-\infty}^{\infty}\left|g\left(\frac{n}{2\omega}\right)\right|^2$, where ω is the highest frequency component of g(t). **(06 Marks)**

c. The signal $g(t) = 2\cos(2000\pi t) - 4\sin(4000\pi t)$ is quantized by rounding off, using a 12-bit quantizer. What is the rms quantization error and the quantization SNR? **(06 Marks)**

3 a. Consider a speech signal with a maximum frequency of 3.4 kHz and maximum amplitude of 1 volt. The speech signal is applied to a D.M. with its bit rate at 20 kbits/sec. Discuss the choice of an appropriate stepsize for the delta modulator. **(05 Marks)**

b. Compare PCM and DPCM. **(04 Marks)**

c. Obtain power spectral density of NRZ bipolar format and draw its normalized PSD. **(11 Marks)**

4 a. Design a binary baseband PAM system to transmit data at a bit rate of 3600 bits/sec, with a bit error probability $< 10^{-4}$. The channel response is given by,

$$H_C(f) = \begin{cases} 10^{-2} & |f| < 2400 \\ 0 & \text{elsewhere} \end{cases}$$

The noise power spectral density is $G_n(f) = 10^{-14}$ watts/Hz, $Q(y) \le 10^{-4}$, $y \ge 3.75$, parameter $\beta = \frac{r_b}{6}$. **(10 Marks)**

b. A binary data sequence is 011011. Sketch the waveform for the following formats:
i) RZ unipolar ii) NRZ Bipolar **(04 Marks)**

c. With a neat structure, explain the concept of the adaptive equalization process. **(06 Marks)**

PART – B

5 a. Explain with a neat block diagram the coherent QPSK Transmitter and Receiver. **(08 Marks)**

b. A binary FSK system transmits data at a rate of 2MBPS over an AWGN channel. The noise is zero mean with PSD, $\frac{N_0}{2} = 10^{-20}\,W/Hz$. The amplitude of received signal in the absence of noise is 1 μV. Determine the average probability of error for coherent detection of FSK. Take $erfc\sqrt{6.25} = 0.00041$ **(06 Marks)**

c. Show that the energy of signal $S_i(t)$ is equal to the square of length of the corresponding vector S_i. **(06 Marks)**

6 a. What do you mean by an optimum receiver with reference to a digital modulation scheme? Write the scheme of a correlation receiver and describe its features. **(06 Marks)**

b. Find the output of the matched filter and determine the maximum value of $\frac{S}{N_0}$ if the input s(t) is a rectangular pulse of amplitude A and duration T. **(08 Marks)**

c. Calculate the bandwidth efficiency of an M-ary signaling scheme. **(06 Marks)**

7 a. Consider the set of signals,

$$S_i(t) = \begin{cases} \sqrt{\frac{2E}{T}}\cos(2\pi f_c t - i\frac{\pi}{4}) & 0 \le t \le T \\ 0 & \text{elsewhere} \end{cases}$$

where i = 0, 1, 2, 3 and f_c is an integer multiple of $\frac{1}{T}$.

i) Determine the dimensionality N of the signal set.
ii) Determine a set of orthogonality N of the signal set.
iii) Determine the coefficients S_{ij} of the signals $S_i(t)$.
iv) Give the signal constellation diagram. **(10 Marks)**

b. What is spread spectrum communication? What is its primary advantage? What are the commonly used spread spectrum technique? **(07 Marks)**

c. Write the applications of spread spectrum technique. **(03 Marks)**

8 Write short notes on:

a. Duobinary signaling.
b. Eye pattern.
c. Correlation receiver.
d. TDM. **(20 Marks)**

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Sixth Semester B.E. Degree Examination, June-July 2009
Microprocessor

Time: 3 hrs. Max. Marks:100

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

PART – A

1 a. Draw the internal architecture of the 8086 and explain. Briefly explain the flag register. **(10 Marks)**

b. Explain the transient program area (TPA) and system area of a personal computer. **(10 Marks)**

2 a. Write an ALP to multiply two 32 bit numbers stored in consecutive memory locations and store the result in the memory. **(10 Marks)**

b. Differentiate between Direct program memory addressing, Relative program memory addressing and Indirect program memory addressing with one or two examples. **(06 Marks)**

c. If DS = AB30H, CS = 8920H, SS = 2BO1H, BP = 2D45H, SP = 0130H, SI = 1234H DI = 4356H then determine the physical address of the following instructions.
i) MOV [BP + DI + 5], AH ii) MOV AL, [5036H] **(04 Marks)**

3 a. Explain the following string instructions:
i) MOVSB ii) Repeat Prefix (REP) iii) STOSW iv) SCASB v) CMPS. **(10 Marks)**

b. Write an ALP to convert lowercase to uppercase using modular programming approach. Use two far procedures one for reading from keyboard and one for displaying. **(10 Marks)**

4 a. Explain the following DOS system call : int 21H functions:
i) 1NT 21H, Function 001H
ii) 1NT 21H, Function 08H
iii) 1NT 21H, Function 0AH
iv) 1NT 21H, Function 2BH
v) 1NT 21H, Function 2DH **(10 Marks)**

b. Draw the pin-out of the 8259 A programmable interrupt controller (PIC) and describe each pin. **(10 Marks)**

PART - B

5 a. Explain Isolated and Memory – Mapped I/O. **(05 Marks)**

b. Explain about the following I/O instructions
i) IN with fixed address ii) IN with variable address iii) INSB
iv) OUT with fixed address v)OUTSW **(05 Marks)**

c. Explain the programmable peripheral interface (PPI) with command bytes of the command register in the 82C55. **(10 Marks)**

6 a. Draw the internal structure of 80 x 87 arithmetic coprocessor and explain. **(10 Marks)**

b. Explain the following 8087 coprocessor instructions:
i) FSQRT; ii) FSTP; iii) F SCALE; iv) F RNDINT; v) F COM **(10 Marks)**

7 a. Write short notes on the following:
i) Peripheral Component Interconnect (PCI); ii) Parallel printer interface (LPT). **(10 Marks)**

b. Explain the Universal Serial Bus (USB) with PIN configuration, USB Data, USB commands. **(10 Marks)**

8 a. Write a note on Pentium microprocessor. **(10 Marks)**

b. Explain about special 80386 registers. **(10 Marks)**

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06EC63

Sixth Semester B.E. Degree Examination, June-July 2009
Analog and Mixed Mode VLSI Design

Time: 3 hrs. Max. Marks:100

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

PART – A

1 a. State the reasons for the pedestal error, droop aperture error and sampling error. **(08 Marks)**

b. State and explain specifications of ADC. **(12 Marks)**

2 a. An 8 bit resistor string DAC was fabricated with a nominal resistor value of 1 kΩ. If the process was able to provide matching of resistors to within 1%, find maximum INL and DNL of the converter. Assume $V_{REF} = 5V$. **(06 Marks)**

b. Explain generic (unweighted) current steering DAC and discuss the related mismatch errors. **(08 Marks)**

c. Design a 4 bit charge scaling DAC using a split array. Assume that $V_{REF} = 5V$ and that C = 0.5 pF. Draw the equivalent circuit for D = 0001 and 0010 and determine the value of the output voltage. **(06 Marks)**

3 a. Explain the principle of single slope ADC and the problems associated with it. **(10 Marks)**

b. Draw the block diagram for 4 bit successive approximation ADC with $V_{REF} = 5V$. Explain the same. Trace the output at various stages for $V_{in} = 3.7V$. **(10 Marks)**

4 a. Explain the purpose of each stage of a voltage comparator. Also explain the working of 1st stage. **(10 Marks)**

b. Show that multiplying quad acts as multiplier when all the MOSFETs in the multiplying quad have the same threshold voltage. **(10 Marks)**

PART – B

5 a. Determine the ideal SNR of a 8 bit data converter with averaging of 20 outputs. **(04 Marks)**

b. Draw the circuit arrangement used for decimation and averaging and explain the same. Determine the transfer function of the same. **(10 Marks)**

c. Bring out the principle of interpolation. **(06 Marks)**

6 a. Describe CMOS process flow with neat sketches. **(10 Marks)**

b. Explain how MOSFET behaves as a capacitor. Also explain floating MOS capacitor. **(10 Marks)**

7 a. Estimate the high-to-low and low-to-high delays in the circuits shown in figure Q7 (a). **(08 Marks)**

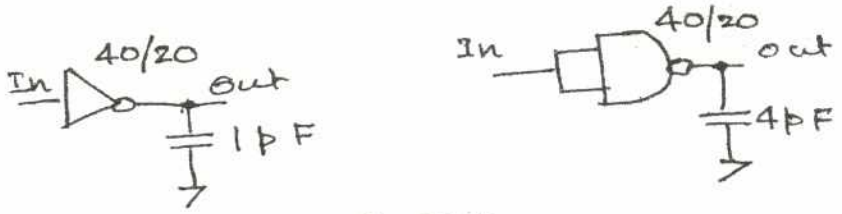

Fig. Q7 (a)

b. Draw the arrangement for 4 bit pipelined adder and full adder bit implemented using dynamic logic. **(06 Marks)**

c. Explain the working of simple delay element using pass transistor and CMOS inverter. **(06 Marks)**

8 a. Explain the limitations of inverter at the output of OPAMP, with the help of its transfer curve. How is it overcome? **(07 Marks)**

b. Consider the AC small signal simplification of floating current source as in figure Q8 (b). Assuming NMOS cascade output resistance is labeled R_{NCOS}, what is the small signal resistance as seen by the test voltage V_{test}? **(07 Marks)**

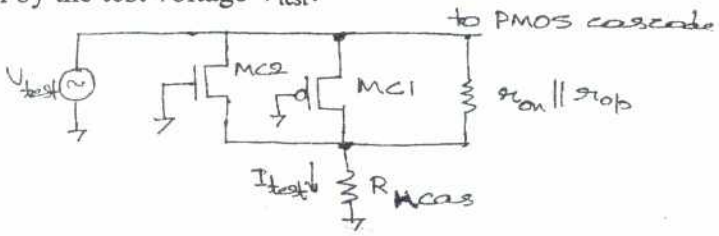

Fig. Q8 (b)

c. Determine time constant of OPAMP with unity gain frequency of 100 MHz. Assume that all the outputs is fed back to the input. Also determine the settling time for 0.1% settling accuracy. **(06 Marks)**

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06EC64

Sixth Semester B.E. Degree Examination, June-July 2009
Antennas and Propagation

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) Radiation intensity ii) Power density derive their relation. **(06 Marks)**

b. State and prove reciprocity theorem for antennas. **(06 Marks)**

c. Determine the directivity of the system if the radiation intensity

i) $U = U_m \cos^3\theta$ ii) $U = U_m \sin\theta \sin^2\phi$. **(08 Marks)**

2 a. Derive an expression for maximum effective Aperture, A_{em}. Also show that A_{em} of $\frac{\lambda}{2}$ dipole is $0.13\lambda^2$. **(10 Marks)**

b. Derive a relation that relates total received power and total transmitted power in terms of directivities. **(06 Marks)**

c. If 'P' is power radiated and 'G' is gain of the antenna, then show that $E = \frac{(30PG)^{1/2}}{r}$. **(04 Marks)**

3 a. Derive an expression for array factor of an array of N–isotropic sources. **(08 Marks)**

b. A Linear antenna consists of 4 – isotropic sources. The distance between adjacent elements is $\frac{\lambda}{2}$. The power is applied with equal magnitudes and a phase difference –dr. Obtain the field pattern and find HPBW. **(08 Marks)**

c. Explain the principle of pattern multiplication. **(04 Marks)**

4 a. Derive the expressions for the field components of a short dipole starting with expressions of electric potential and vector magnetic potential. Also determine the far field components. **(14 Marks)**

b. Derive an expression for radiation resistance of a short-dipole. **(06 Marks)**

PART – B

5 a. Derive the expressions for the field strengths E_ϕ and H_θ in case of small loop. **(10 Marks)**

b. The radius of a circular loop antenna is 0.02λ. How many turns of the antenna will give a radiation resistance of 35Ω? **(05 Marks)**

c. Explain the necessity of flaring of walls of waveguide in case of Horn antennas. **(05 Marks)**

6 a. Describe a Helical Antenna. Explain its two modes of operation with relevant expressions. **(12 Marks)**

b. Explain the operation of log-periodic antennas. **(05 Marks)**

c. List the merits and demerits of lens antenna. **(03 Marks)**

7 a. Derive an expression for space wave field intensity and show that it varies sinusoidally. **(10 Marks)**

b. Explain Duct propagation. **(06 Marks)**

c. Find the maximum range of a tropospheric transmission for which transmitting antenna height is 100 ft and receiving antenna height is 50ft. **(04 Marks)**

8 a. Explain the mechanism of Ionospheric propagation. Also derive an expression for the refractive index of an Ionospheric layer. **(10 Marks)**

b. Discuss the effect of Earth's magnetic field on Ionospheric propagation. **(06 Marks)**

c. A high frequency radio link has to be established between two points on the earth 200 km away. The reflection region of the ionosphere is at a height of 200 km and has a critical frequency of 6 MHz. Calculate the MUF for the given path in case of flat earth. **(04 Marks)**

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06EC65

Sixth Semester B.E. Degree Examination, June-July 2009
Information Theory and Coding

Time: 3 hrs. Max. Marks:100

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

PART – A

1 a. Find an expression for average information content of symbols in long independent sequences. **(03 Marks)**

b. A source produces symbols A, B, C with equal probabilities at a rate of 100/sec. Due to noise on the channel, the probabilities of correct reception of the various symbols are as shown in Table Q1 (b).

		y_j		
	P(j/i)	A	B	C
x_i	A	3/4	1/4	0
	B	1/4	1/2	1/4
	C	0	1/4	3/4

Table Q1 (b)

Determine the rate at which information is being transmitted. **(07 Marks)**

c. For the second order Markov source Figure Q1 (c) with binary source alphabet (s = 0, 1), find: i) State probabilities. ii) Entropy of each state. iii) Entropy of source. iv) Show that $G_1 > G_2 > H(s)$. **(10 Marks)**

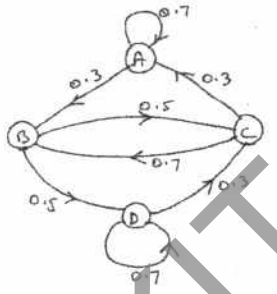

Fig. Q1 (c)

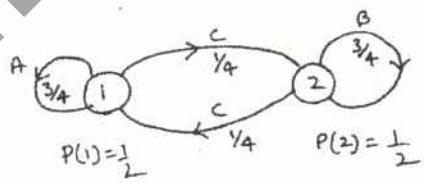

Fig. Q2 (b)

2 a. Explain the steps in the Shannon's Encoding algorithm for generating binary code. **(04 Marks)**

b. Using Shannon's encoding algorithm find the binary code for symbols of length 1 and 2 (i.e. N = 1&2) generated by the information source given in figure Q2 (b). Also compute the average number of bits/symbol and efficiency of the codes for both cases. **(10 Marks)**

c. For the entropy of a zero memory source, prove the extremal property. **(06 Marks)**

3 a. A non symmetric binary channel shown in figure Q3 (a) has a symbol rate of 1000 symbols/sec.

i) Find H(X), H(Y), H(X, Y), H(X/Y), H(Y/X), I(XY). Take P(X=0)=1/4, P(X=1)=3/4, $\alpha = 0.75$, $\beta = 0.9$.

ii) Find the capacity of channel for case (i).

iii) Find the capacity of the binary symmetric channel when $\alpha=\beta=0.75$. **(10 Marks)**

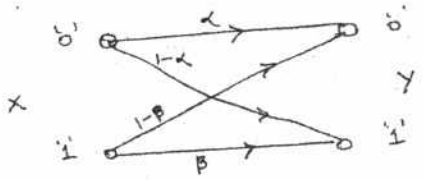

Fig. Q3 (a)

b. Explain mutual information. Find an expression for mutual information in terms of joint probability, probabilities of input and output symbols. **(05 Marks)**

c. Show that mutual information is always positive. **(05 Marks)**

4 a. State and prove Shannon-Hartley law. Derive an expression for the upper limit on channel capacity as bandwidth tends to ∞. **(08 Marks)**

b. Two independent random variables x and y have density functions f(x) and f(y) as shown in Figure Q4 (b).

Fig. Q4 (b)

i) Find the entropy of each signal and the joint entropy.

ii) If the signals are overlapped find f(x, y) and the joint entropy. **(04 Marks)**

c. The output of a DMS consist of letters x_1, x_2, x_3 with probabilities 0.45, 0.35, 0.20 respectively.

i) Compute the Huffman code for this source and also find code efficiency and variance.

ii) If pairs of letter are encoded, compute the Huffman code, code efficiency and variance. **(08 Marks)**

PART – B

5 a. Explain the need and meaning of error control coding. **(05 Marks)**

b. For a linear block code with generator matrix G and parity check matrix H, prove that $GH^T = 0$ in systematic format. **(05 Marks)**

c. For a systematic (6, 3) linear block code the parity matrix, $[P]=\begin{bmatrix}1 & 0 & 1\\ 0 & 1 & 1\\ 1 & 1 & 0\end{bmatrix}$

i) Find all possible code vectors.

ii) Find the minimum weight of the code.

iii) Find the parity check matrix.

iv) For a received code vector R = 1 1 1 1 0 1 detect and correct the error that has occurred due to noise. **(10 Marks)**

6 a. Define cyclic code. Explain how cyclic codes are generated from the generating polynomials. **(06 Marks)**

b. The generator polynomial for a (7, 4) binary cyclic code is $g(x)=1+x+x^3$

i) Find the code vector in systematic form for a message vector 1 1 0 0.

ii) Design an encoder for the above and verify its operation for message vector 1 1 0 0. **(14 Marks)**

7 Consider a (3, 1, 2) convolutional code with $g^{(1)} = 110$, $g^{(2)} = 101$, $g^{(3)} = 111$.

a. Draw the encoder block diagram.

b. Find the generator matrix.

c. Find the code word corresponding to the information sequence (1 1 1 0 0) using time domain and transform domain approach.

d. Draw the state table.

e. Draw the state diagram.

f. Draw the code tree and find encoder output for message sequence (1 1 1 0 0) **(20 Marks)**

8 Write short notes on:

a. RS codes. b. Golay codes. c. Shortened cyclic codes. d. Burst error correcting codes. **(20 Marks)**

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