CBCS Scheme

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15EC52

Fifth Semester B.E. Degree Examination, June/July 2018
Digital Signal Processing

Time: 3 hrs. Max. Marks: 80

Note: 1. *Answer FIVE full questions, choosing one full question from each module.*
2. *Use of filter table is not permitted.*

Module-1

1 a. Compute N-point DFT of a sequence $x(n)=\frac{1}{2}+\frac{1}{2}\cos\left(\frac{2\pi}{N}\left(n-\frac{N}{2}\right)\right)$. **(08 Marks)**

b. Compute 4-point circular convolution of the sequences using time domain and frequency domain.
$x(n)=\{2,1,2,1\}$ and $h(n)=\{1,2,3,4\}$ **(08 Marks)**

OR

2 a. Obtain the relationship between DFT and z-transform. **(08 Marks)**

b. Let x(n) be a real sequence of length N and its N-point DFT is X(K), show that
(i) $X(N-K)=X^*(K)$
(ii) $X(0)$ is real.
(iii) If N is even, then $X\left(\frac{N}{2}\right)$ is real. **(08 Marks)**

Module-2

3 a. Let x(n) be a finite length sequence with $X(K)=\{10,1-j,4,1+j\}$, using properties of DFT, find the DFT of the followings:
(i) $x_1(n)=e^{j\frac{\pi}{2}n}x(n)$
(ii) $x_2(n)=\left\{\cos\frac{\pi}{2}n\right\}x(n)$ **(08 Marks)**

b. Find the response of an LTI system with an impulse response $h(n)=\{3,2,1\}$ for the input $x(n)=\{2,-1,-1,-2,-3,5,6,-1,2,0,2,1\}$, using overlap add method. Use 8-point circular convolution. **(08 Marks)**

OR

4 a. State and prove the,
(i) Modulation property. (ii) Circular time shift property. **(08 Marks)**

b. Consider a finite duration sequence $x(n)=\{0,1,2,3,4,5\}$
(i) Find the sequence, y(n) with 6 point DFT is $y(K)=W_6^K X(K)$.
(ii) Determine the sequence y(n) with 6-point DFT $y(K)=\text{Real}[X(K)]$. **(08 Marks)**

Module-3

5 a. Develop the radix – 2 Decimation in frequency FFT algorithm for N = 8 and draw the signal flow graph. **(10 Marks)**

b. What is Goertzel algorithm and obtain the direct form – II realization? **(06 Marks)**

OR

6 a. Let x(n) be the 8-point sequence of $x(n) = \left\{\underset{\uparrow}{\frac{1}{\sqrt{2}}}, 1, \frac{1}{\sqrt{2}}, 0, \frac{-1}{\sqrt{2}}, -1, \frac{-1}{\sqrt{2}}, 0\right\}$. Compute the DFT of the sequence using DIT FFT algorithm. **(06 Marks)**

b. What is Chirp-Signals and mention the applications of Chirp-Z-transform? **(04 Marks)**

c. 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. **(06 Marks)**

Module-4

7 a. Design a digital low pass Butterworth Filter using bilinear transformation to meet the following specifications:

$-3\,dB \le |H(e^{j\omega})| \le -1\,dB$ for $0 \le \omega \le 0.5\pi$

$|H(e^{j\omega})| \le -10\,dB$ for $0.7\pi \le \omega \le \pi$ **(10 Marks)**

b. Obtain the parallel form of realization of a system difference equation,

$y(n) = 0.75y(n-1) - 0.125y(n-2) + 6x(n) + 7x(n-1) + x(n-2)$ **(06 Marks)**

OR

8 a. Convert the analog filter with system function,

$H_a(s) = \frac{s + 0.1}{(s + 0.1)^2 + 9}$ into a digital IIR filter by means of the impulse invariance method. **(08 Marks)**

b. Obtain the DF-I and cascade form of realization of the system function,

$$H(z) = \frac{1 + \frac{1}{3}z^{-1}}{\left(1 - \frac{1}{5}z^{-1}\right)\left(1 - \frac{3}{4}z^{-1} + \frac{1}{8}z^{-2}\right)}$$ **(08 Marks)**

Module-5

9 a. Obtain the linear phase realization of FIR filter with impulse response,

$h(n) = \delta(n) - \frac{1}{2}\delta(n-1) + \frac{1}{4}\delta(n-2) + \frac{1}{4}\delta(n-3) - \frac{1}{2}\delta(n-4) + \delta(n-5)$. **(06 Marks)**

b. What are the advantages and disadvantages of the window technique for designing FIR filter? **(04 Marks)**

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

$$H_d(e^{j\omega}) = \begin{cases} e^{-j2\omega}, & |\omega| < \frac{\pi}{4} \\ 0, & \frac{\pi}{4} < |\omega| < \pi \end{cases}$$

Determine the filter coefficients $h_d(n)$ and $h(n)$ if $\omega(n)$ is a rectangular window defined as,

$$\omega_R(n) = \begin{cases} 1, & 0 \le n \le 4 \\ 0, & \text{Otherwise} \end{cases}$$ **(06 Marks)**

OR

10 a. The desired frequency response of a low pass filter is given by,

$$H_d(e^{j\omega}) = \begin{cases} e^{-j3\omega}, & |\omega| < \frac{3\pi}{4} \\ 0, & \frac{3\pi}{4} < |\omega| < \pi \end{cases}$$. Determine the frequency response of the FIR filter if Hamming window is used with N = 7. **(10 Marks)**

b. Realize an FIR filter with impulse response h(n) given by,

$h(n) = \left(\frac{1}{2}\right)^n [u(n) - u(n-4)]$ using direct form. **(06 Marks)**

CBCS SCHEME

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15EC54

Fifth Semester B.E. Degree Examination, June/July 2018
Information Theory and Coding

Time: 3 hrs. Max. Marks: 80

Note: Answer any FIVE full questions, choosing one full question from each module.

Module-1

1 a. With neat sketch, explain the block diagram of an information system. **(04 Marks)**

b. Define entropy. State various properties of the entropy. **(04 Marks)**

c. A code is composed of dots and dashes. Assuming a dash is 3 times as long as a dot and has one-third the probability of occurrence. Calculate:

i) The information in a dot and a dash.

ii) The entropy of dot-dash code.

iii) The average rate of information if a dot lasts for 10mili seconds and the same time is allowed between symbols. **(08 Marks)**

OR

2 a. Derive an expression for the entropy of n^{th} extension of a zero memory source. **(06 Marks)**

b. The first order Markoff model shown in Fig.Q.2(b). Find the state probabilities, entropy of each state and entropy of the source. **(10 Marks)**

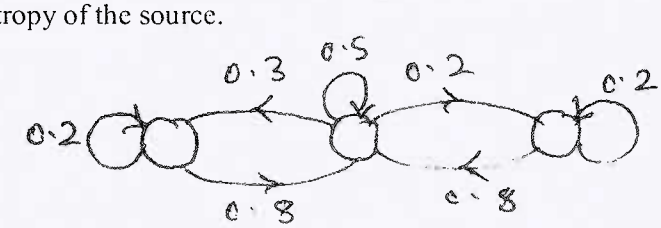

Fig.Q.2(b)

Module-2

3 a. Apply Shannon's binary encoding algorithm to the following set of symbols given in table below. Also obtain code efficiency. **(08 Marks)**

Symbols	A	B	C	D	E
P	1/8	1/16	3/16	1/4	3/8

b. Consider a source S = $\{s_1, s_2\}$ with probabilities 3/4 and 1/4 respectively. Obtain Shannon-Fano code for source S and its 2^{nd} extension. Calculate efficiencies for each case. Comment on the result. **(08 Marks)**

OR

4 a. Consider a source with 8 alphabets A to H with respective probabilities of 0.22, 020, 018, 015, 0.10, 0.08, 0.05 and 0.02. Construct Huffman's code and determine its efficiency. **(10 Marks)**

b. With an illustrative example, explain arithmetic coding technique. **(06 Marks)**

Module-3

5 a. Define: i) Input entropy ii) Output entropy iii) Equivocation iv) Joint entropy and v) Mutual information with the aid of respective equations. **(04 Marks)**

b. In a communication system, a transmitter has 3 input symbols A = $\{a_1, a_2, a_3\}$ and receiver also has 3 output symbols B = $\{b_1, b_2, b_3\}$. The matrix given below shows JPM. **(08 Marks)**

a_i \ b_j	b_1	b_2	b_3
a_1	$\frac{1}{12}$	*	$\frac{5}{36}$
a_2	$\frac{5}{36}$	$\frac{1}{9}$	$\frac{5}{36}$
a_3	*	$\frac{1}{6}$	*
$P(b_j)$	$\frac{1}{3}$	$\frac{14}{36}$	*

i) Find missing probabilities (*) in the table.

ii) Find $P\left(\frac{b_3}{a_1}\right)$ and $P\left(\frac{a_1}{b_3}\right)$.

c. A transmitter has 5 symbols with probabilities 0.2, 0.3, 0.2, 0.1 and 0.2. Given the channel matrix P(B/A) as shown below, calculate H(B) and H(A, B). **(04 Marks)**

$$P(B/A)=\begin{bmatrix} 1 & 0 & 0 & 0 \\ 1/4 & 3/4 & 0 & 0 \\ 0 & 1/3 & 2/3 & 0 \\ 0 & 0 & 1/3 & 2/3 \\ 0 & 0 & 1 & 0 \end{bmatrix}$$

Fig.Q.5(c)

OR

6 a. A Gaussian channel has a 10MHz bandwidth. If (S/N) ratio is 100, calculate the channel capacity and the maximum information rate. **(04 Marks)**

b. A binary symmetric channel has channel matrix $P(Y/X)=\begin{vmatrix} 3/4 & 1/4 \\ 1/4 & 3/4 \end{vmatrix}$ with source probabilities of $P(X_1)=\frac{2}{3}$ and $P(X_2)=\frac{1}{3}$.

i) Determine H(X), H(Y), H(Y/X) and H(X, Y).

ii) Find the channel capacity. **(06 Marks)**

c. Find the channel capacity of the channel shown in Fig.Q.6(c) using Muroga's method. **(06 Marks)**

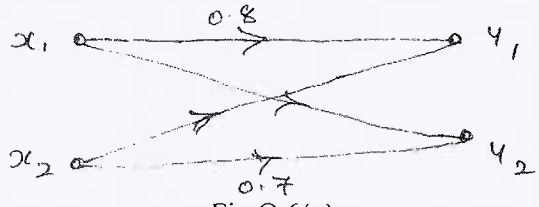

Fig.Q.6(c)

Module-4

7 a. Distinguish between "block codes" and "convolution codes". **(02 Marks)**

b. For a systematic (6, 3) linear block code, the parity matrix is $P = \begin{vmatrix} 1 & 0 & 1 \\ 0 & 1 & 1 \\ 1 & 1 & 0 \end{vmatrix}$. Find all possible code vectors. **(08 Marks)**

c. The parity check bits of a (8, 4) block code are generated by $c_5 = d_1 + d_2 + d_4$, $c_6 = d_1 + d_2 + d_3$, $c_7 = d_1 + d_3 + d_4$ and $c_8 = d_2 + d_3 + d_4$ where d_1, d_2, d_3 and d_4 are message bits. Find the generator matrix and parity check matrix for this code. **(06 Marks)**

OR

8 a. A (7, 4) cyclic code has the generator polynomial $g(x) = 1 + x + x^3$. Find the code vectors both in systematic and nonsystematic form for the message bits (1001) and (1101). **(12 Marks)**

b. Consider a (15, 11) cyclic code generated by $g(x) = 1 + x + x^4$. Device a feed back shift register encoder circuit. **(04 Marks)**

Module-5

9 a. Write a note on BCH codes. **(06 Marks)**

b. Consider the (3, 1, 2) convolutional encoder with $g^{(1)} = (110)$, $g^{(2)} = (101)$ and $g^{(3)} = (111)$.

i) Draw the encoder diagram.

ii) Find the generator matrix.

iii) Find the code word for the message sequence (11101). **(10 Marks)**

OR

10 a. For a (2, 1, 3) convolutional encoder with $g^{(1)} = (1101)$, $g^{(2)} = (1011)$, draw the encoder diagram and code tree. Find the encoded output for the message (11101) by traversing the code tree. **(10 Marks)**

b. Describe the Viterbi decoding algorithm. **(06 Marks)**

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10EC52

Fifth Semester B.E. Degree Examination, June/July 2018
Digital Signal Processing

Time: 3 hrs. Max. Marks:100

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

PART – A

1 a. Derive the DFT expression from the DTFT expression. **(06 Marks)**

b. Compute 5-point DFT of x(n) = {1, 1, 1}. **(07 Marks)**

c. Find IDFT for the sequence, X(K) = {5, 0, (1-j), 0, 1, 0, (1+j), 0} **(07 Marks)**

2 a. State and prove circular time shift and frequency shift property of DFT. **(05 Marks)**

b. Determine N-point circular correlation of $x_1(n)$ and $x_2(n)$, given $x_1(n) = \cos\frac{2\pi}{N}n$ and $x_2(n) = \sin\frac{2\pi}{N}n$. **(08 Marks)**

c. Compute circular convolution of x(n) = {1, 2, 3, 4} and h(n) = {1, 2, 2} using time domain approach. **(07 Marks)**

3 a. Find the output y(n) of a filter whose impulse response h(n) = {1, 2} and the input signal to the filter is, x(n) = { 1, 2, -1, 2, 3, -2, -3, -1, 1, 1, 2, -1} using overlap – save method. **(08 Marks)**

b. Find 4-point DFT of two real sequences using a single 4-point DFT, given g(n) = {1, 2, 0, 1} and h(n) = {2, 2, 1, 1}. **(08 Marks)**

c. State and prove (i) Symmetry and (ii) Periodicity property of a twiddle factor. **(04 Marks)**

4 a. Develop Radix-2, DITFFT algorithm to compute DFT of a sequence, draw the signal flow graph, for N = 8. **(08 Marks)**

b. Obtain 8-point DFT of a sequence $x(n) = (n+1)[u(n) - u(n-8)]$, using DIF-FFT algorithm, show all the intermediate results. **(08 Marks)**

c. Write a note on Geortzal algorithm. **(04 Marks)**

PART – B

5 a. Derive an expression for order and cutoff frequency of a Butterworth low pass filter. **(06 Marks)**

b. Design an analog Chebyshev filter having following specifications:
(i) Passband ripple of 3 dB at 500Hz.
(ii) Attenuation of 15 dB at 750 Hz. **(10 Marks)**

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

6 a. Obtain the cascade and parallel form realization of,
$$H(z) = \frac{8z^3 - 4z^2 + 11z - 2}{\left(z - \frac{1}{4}\right)\left(z^2 - z + \frac{1}{2}\right)}.$$ **(10 Marks)**

b. A FIR filter is described by Transfer function, $H(z) = 1 + \frac{2}{5}z^{-1} + \frac{3}{4}z^{-2} + \frac{1}{3}z^{-3}$,
(i) Draw Lattice structure.
(ii) Obtain its difference equation.
(iii) Draw Direct form structure. **(10 Marks)**

7 a. Derive an expression for frequency response of a symmetric FIR filter, for N = odd. **(08 Marks)**

b. Design a LPF with the frequency response, $H_d(j\omega) = \begin{cases} e^{-j2\omega}, & |\omega| < \frac{\pi}{4} \\ 0, & \frac{\pi}{4} < |\omega| < \pi \end{cases}$

using rectangular window. Also find its impulse response and frequency response. **(08 Marks)**

c. Explain the frequency sampling design of FIR filters. **(04 Marks)**

8 a. Derive the expression for the bilinear transformation, to transform an analog filter to digital filter, explain the characteristics of mapping from s-plane to z-plane. **(08 Marks)**

b. Given the analog transfer function, $H(z) = \frac{s+2}{(s+1)(s+3)}$, find H(z) using matched z-transform. **(04 Marks)**

c. Design a digital lowpass filter using Bilinear transformation to satisfy the following characteristics:

(i) Monotonic stopband and passband.

(ii) -3 dB cutoff frequency of 0.5π rad.

(iii) Magnitude down atleast 15 dB at 0.75π rad. **(08 Marks)**

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10EC53

Fifth Semester B.E. Degree Examination, June/July 2018
Analog Communication

Time: 3 hrs. Max. Marks:100

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

PART – A

1 a. What is Gaussian process? Mention the properties of Gaussian process. **(06 Marks)**

b. Define mean, correlation and co-variance of random process x(t). **(06 Marks)**

c. Let x have the uniform distribution given by

$$f_x(x) = \frac{1}{2\pi} \quad 0 \le x \le 2\pi$$

$$0 \quad \text{elsewhere}$$

Calculate mean, mean square value, variance and standard deviation. **(08 Marks)**

2 a. Explain generation of an AM wave using a switching modulator with mathematical equation. **(08 Marks)**

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

c. With the help of block diagram, explain Costas receiver, which is used for de-modulating DSB-SC singles. **(06 Marks)**

3 a. Explain the generation of SSB-SC wave using phase discrimination method with mathematical proof. **(08 Marks)**

b. Find the Hilbert transform of the pulse given below, **(06 Marks)**

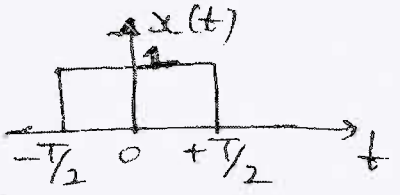

Fig.Q3(b)

c. Define Hilbert transform, pre-envelope and complex envelope. **(06 Marks)**

4 a. Show that a VSB modulated wave s(t) containing a vestiage of the lower side band is defined by $s(t) = \frac{A_c}{2} m_I(t) \cos \omega_c t - \frac{A_c}{2} m_Q(t) \sin \omega_c t$. **(06 Marks)**

b. Explain the concept of frequency translation with frequency spectrum. **(06 Marks)**

c. Give a comparison of amplitude modulation techniques. **(08 Marks)**

PART – B

5 a. Explain the generation of FM using VCO method. **(07 Marks)**

b. Find the instantaneous frequency in hertz of each of the following signals.

i) $10 \cos (200\pi t + \pi/3)$

ii) $10 \cos (20\pi t + \pi t^2)$

iii) $\cos 200\pi t \cos(5\sin 2\pi t) + \sin 200\pi t \sin (5 \sin 2\pi t)$. **(06 Marks)**

c. Compare wideband and narrowband FM systems. **(07 Marks)**

6 a. With relevant mathematical expression, explain PLL detection using non-linear model. **(07 Marks)**

b. In a broadcast super-heterodyne receiver, having no RF amplifier, the loaded 'Q' of the antenna coupling circuit is 100. If the intermediate frequency is 455KHz. Calculate the image frequency and its rejection ratio for tuning at 2000KHz. **(06 Marks)**

c. With neat block diagram discuss FM stereo multiplexing and de-multiplexing system. **(07 Marks)**

7 a. Derive the expression for noise factor of two amplifiers connected in cascade. **(08 Marks)**

b. Define and derive equivalent noise temperature with cascade connection of amplifiers. **(06 Marks)**

c. A mixer stage has a noise figure of 20dB. It is preceded by an amplifier, which has a noise figure of 9dB and an available power gain of 15dB. Calculate the overall noise figure referred to the input. **(06 Marks)**

8 a. Discuss the noise in DSB-SC receiver with a model receiver using coherent detection. Prove that the figure of merit for such a receiver is unity? **(12 Marks)**

b. Explain the concept of pre-emphasis and de-emphasis in FM system. **(08 Marks)**

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10EC54

Fifth Semester B.E. Degree Examination, June/July 2018
Microwave and Radar

Time: 3 hrs. Max. Marks:100

Note: 1. ***Answer FIVE full questions, selecting at least TWO questions from each part.***
2. Use of Smith Chart is permitted.

PART – A

1 a. What are distributed parameters of a Transmission line? Derive characteristic impedence (Z_0) and propagation constant for a microwave transmission line. **(06 Marks)**

b. Derive the expression for input impedance of a transmission line terminated with a load impedance of Z_l. **(06 Marks)**

c. A line of $R_0 = 400\ \Omega$ is connected to a load impedance of $200 + j300\ \Omega$, which is excited by a matched generator at 800 MHz. Find the location and length of a single stub nearest to the load to produce an impedance match. **(08 Marks)**

2 a. Derive electric and magnetic field components for TE modes in rectangular waveguide. **(08 Marks)**

b. With neat sketches, explain directional coupler and derive its s-matrix. **(08 Marks)**

c. Explain rectangular microwave cavity resonators with necessary diagrams and expressions. **(04 Marks)**

3 a. Explain RWH theory with reference to the Gunn diode operation. **(08 Marks)**

b. Describe the operating principle of IMPATT diode and obtain the expressions for output power and efficiency. **(08 Marks)**

c. An M-Si-M BARITT diode has the following parameters :
Relative dielectic constant of S_i : $\in_r = 11.8$
Donor concentration : $N = 3 \times 10^{21}\ m^{-3}$
S_i length : $L = 6.2\ \mu m$
Calculate : (i) breakdown voltage
(ii) breakdown electric field **(04 Marks)**

4 a. Describe the properties of s-matrix. **(08 Marks)**

b. Prove that impedances and admittances are symmetrical for a Reciprocal network. **(06 Marks)**

c. The S-parameters of a two-port network are given by, $S_{11} = 0.2\angle 0^0$, $S_{22} = 0.1\angle 0^0$, $S_{12} = 0.6\angle 90^0$, $S_{21} = 0.6\angle 90^0$ (i) Prove that the network is reciprocal but not lossless (ii) Find the return loss at Port 1 when Port 2 is short circuited. **(06 Marks)**

PART – B

5 a. Obtain the S-matrix for a Magic-T and explain its applications. **(10 Marks)**

b. With neat sketches, explain the operation of precision type variable attenuator. **(06 Marks)**

c. A 20 mW signal is fed into one of the collinear ports 1 of a lossless H-plane Tee. Calculate the power delivered through each port when other parts are terminated in matched load. **(04 Marks)**

6 a. Explain various lossless in strip lines. **(08 Marks)**

b. Describe parallel strip lines and express distributed parameters in terms of strip line dimensions. **(08 Marks)**

c. A shielded strip line has the following parameters: Dielectric constant of insulator, $\epsilon_r = 2.56$, strip width W = 25 mils, Strip thickness t = 14 mils, shield depth d = 70 mils. Calculate (i) The K factor (ii) The fringe capacitance (iii) The characteristic impedance. **(04 Marks)**

7 a. Derive simple form of Radar range equation. **(08 Marks)**

b. Describe the various applications of Radar. **(06 Marks)**

c. A Radar operating at 3 GHz is radiating power of 200 kW. Calculate the power of the reflected signal at the Radar with a 20 m^2 target at 5.56 km. Given $A_e = 9\,m^2$. **(06 Marks)**

8 a. With a neat block diagram explain M.T.I Radar. **(07 Marks)**

b. What are delay line cancellers? Explain. **(07 Marks)**

c. A 3.25 cm pulse Doppler RADAR has a pulse repition frequency of 4000PPS.
Find (i) Maximum unambiguous range. (ii) Maximum Doppler frequency shift and
(iii) Maximum radial velocity of the target. **(06 Marks)**

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10EC55

Fifth Semester B.E. Degree Examination, June/July 2018
Information Theory and Coding

Time: 3 hrs. Max. Marks:100

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

PART – A

1 a. Define :
i) Self information
ii) Rate of source
iii) Entropy of source. **(06 Marks)**

b. Output of an information source consists of 128 symbols 16 of which occur with a probability of 1/32 and the remaining occur with a probability of 1/224. The source emits 1000 symbols/sec. Assuming that the symbols are chosen independently. Find the average information rate of the source. **(04 Marks)**

c. The state diagram of Markov source is given in Fig.Q1(c) : $P_i = \frac{1}{3}$; for i = 1, 2, 3
i) Find the entropy of each state H_i(i = 1, 2, 3)
ii) Find entropy of the source H
iii) Find G_1 and G_2 and show that $G_1 \geq G_2 \geq H$. **(10 Marks)**

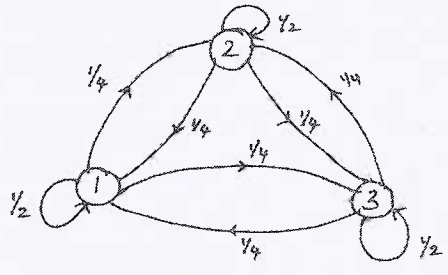

Fig.Q1(c)

2 a. Write Shannon's encoding algorithm. **(04 Marks)**

b. Apply Shannon's encoding algorithm to the following messages :

S_1	S_2	S_3
0.5	0.3	0.2

i) Find code efficiency and redundancy
ii) If the same technique is applied to the 2nd order extension of this source, how much will the code efficiency be improved? **(08 Marks)**

c. An analog has 4KHz bandwidth. The signal is sampled at 2.5 times the Nyquist rate and each sample is quantized into 256 equally likely levels. Assume that the successive samples are stastically independent :
i) Find the information rate of this source
ii) Can output of this source be transmitted without errors over a Guassian channel for bandwidth 50Hz and S/N ratio of 26dB
iii) If the output of this source is to be transmitted without errors over an analog channel having S/N ratio of 16dB, compute the bandwidth requirement of the channels. **(08 Marks)**

3 a. Write Huffman encoding procedure for obtaining compact code with least redundancy. **(04 Marks)**

b. Given 8 symbols source with probabilities
P = {0.25, 0.20, 0.15, 0.15, 0.10, 0.05, 0.05, 0.05}
Construct two binary Huffman coding as described below :
i) Place the composite symbol as low as possible
ii) Place the composite symbol as high as possible
In each case determine the code word and efficiency. **(08 Marks)**

c. The noise characteristics of a channel is as shown in Fig.Q3(c). Find the channel capacity (Using Muroga's method). **(08 Marks)**

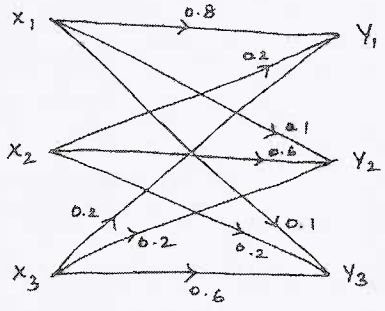

Fig.Q3(c)

4 a. List the properties of mutual information and prove the following :
i) $I(X ; Y) = I(Y ; X)$
ii) $I(X ; Y) \geq 0$. **(08 Marks)**

b. Two noisy channels are cascaded whose channel matrix are given by :

$$P\left(\frac{y}{x}\right) = \begin{bmatrix} 1/6 & 1/6 & 2/3 \\ 1/2 & 1/4 & 1/4 \end{bmatrix}, \quad P\left(\frac{z}{y}\right) = \begin{bmatrix} 1/2 & 1/2 & 0 \\ 1/3 & 2/3 & 0 \\ 0 & 1/3 & 2/3 \end{bmatrix}$$

With $P(x_1) = P(x_2) = \frac{1}{2}$. Find : i) $I(x ; y)$ ii) $I(x ; z)$. **(12 Marks)**

PART – B

5 a. What are the methods of controlling errors? Explain. **(04 Marks)**

b. Mention types of errors and explain. **(04 Marks)**

c. The parity check bits of a (7, 4) Hamming code are generated by :

$C_5 = d_1 \oplus d_3 \oplus d_4$

$C_6 = d_1 \oplus d_2 \oplus d_3$

$C_7 = d_2 \oplus d_3 \oplus d_4$

Where d_1, d_2, d_3 and d_4 are message bits.
i) Find generator matrix [G] and parity check matrix[H]
ii) Prove that $GH^T = 0$
iii) The (n, k) linear block code so obtained has a dual code. This dual code is a (n, n – k) code having a generator matrix H and parity check matrix G. Determine the eight code vectors of the dual code for (7, 4) Hamming code described above
iv) Find the minimum distance of the dual code determined in part(iii). **(12 Marks)**

6 a. Explain the operation of an encoder using (n, k) bit shift register. **(04 Marks)**

b. Design the encoder for the (7, 4) cyclic code generated by generator polynomial $G(P) = P^3 + P + 1$ and verify this operation for message vector M = 1100. **(04 Marks)**

c. For a systematic (7, 4) linear block code the parity matrix P is given by

$$P = \begin{bmatrix} 1 & 1 & 1 \\ 1 & 1 & 0 \\ 1 & 0 & 1 \\ 0 & 1 & 1 \end{bmatrix}$$

i) Find all Possible valid code vectors

ii) Draw the corresponding encoding circuit

iii) A single error has occurred in each of this received vectors. Detect and correct those errors.

$Y_A = 0111110$

$Y_B = 1011100$

$Y_C = 1010000$

iv) Draw the syndrome calculation circuit. **(12 Marks)**

7 Write an explanatory note on following :

a. R.S codes

b. Golay codes

c. Shortened cyclic codes

d. Burst error correcting codes. **(20 Marks)**

8 Consider the (3, 1, 2) convolution code with impulse response $g^{(1)} = 110$, $g^{(2)} = 101$, $g^{(3)} = 111$

a. Draw the encoder block diagram

b. Find generator matrix

c. Find the codeword corresponds to the message sequence 11101 using :

i) Time domain approach

ii) Transform domain approach. **(20 Marks)**

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CBCS Scheme

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15EC61

Sixth Semester B.E. Degree Examination, June/July 2018

Digital Communication

Time: 3 hrs. Max. Marks: 80

Note: Answer any FIVE full questions, choosing one full question from each module.

Module-1

1 a. Define Hilbert transform. List the properties of the Hilbert transform. **(04 Marks)**

b. Obtain the canonical representation of band pass signals. **(06 Marks)**

c. What is line coding? For the binary stream 011010 sketch the following line codes:
i) Unipolar NRZ
ii) Polar NRZ
iii) Unipolar RZ
iv) Bipolar RZ
v) Manchester **(06 Marks)**

OR

2 a. Define pre-envelope of a real valued signal. Given a band pass signal s(t), sketch the amplitude spectra of signal s(t), pre-envelope $s_+(t)$ and complex envelope $\tilde{s}(t)$. **(04 Marks)**

b. Derive the expression for the complex low pass representation of band pass systems. **(08 Marks)**

c. Write a note on HDBN signaling. **(04 Marks)**

Module-2

3 a. Explain the geometric representation of signals. Show that energy of the signal is equal to the squared length of the vector representing it. **(08 Marks)**

b. Derive the expressions for mean and variance of the correlator outputs. Also show that the correlator outputs are statistically independent. **(08 Marks)**

OR

4 a. Explain the Gram-Schmidt orthogonalization procedure. **(06 Marks)**

b. Obtain the maximum likelihood decision rule for the signal detection problem. **(10 Marks)**

Module-3

5 a. Explain the signal space representation for binary phase shift keying modulation. Also derive the expression for the probability of error for the binary phase shift keying. **(10 Marks)**

b. With a neat block diagram, explain the generation and coherent detection of QPSK signals. **(06 Marks)**

OR

6 a. With a neat block diagram, explain the non-coherent detection of binary frequency shift keying technique. **(04 Marks)**

b. Derive an expression for probability of error of binary frequency shift keying technique. Also draw the block diagrams of BFSK transmitter and coherent receiver. **(10 Marks)**

c. For the binary sequence given by 10010011, illustrate the operation of DPSK. **(02 Marks)**

Module-4

7 a. With a neat block diagram of digital PAM system obtain the expression for inter symbol interference (ISI). **(06 Marks)**

b. State and prove Nyquist condition for zero ISI. **(06 Marks)**

c. For the binary data sequence $\{d_n\}$ given by 11101001. Determine the precoded sequence, transmitted sequence, received sequence and the decoded sequence. **(04 Marks)**

OR

8 a. Explain the design of band limited signals with controlled ISI. **(10 Marks)**

b. What is a zero forcing equalizer? With a neat block diagram, explain the operation of linear transversal filter. **(06 Marks)**

Module-5

9 a. Explain the model of a spread spectrum digital communication system. **(06 Marks)**

b. Explain the generation and demodulation of direct sequence spread spectrum signals with necessary equation and block diagram. **(07 Marks)**

c. Write a note on low detectability signal transmission as an application of direct sequence spread spectrum. **(03 Marks)**

OR

10 a. With a neat block diagram, explain the frequency hopped spread spectrum. **(07 Marks)**

b. Explain the effect of despreading on a Narrow band interference in direct sequence spread spectrum systems. A direct sequence spread spectrum signal is designed to have the power ratio P_R/P_N at the intended receiver is 10^{-2}. If the desired $E_b/N_o = 10$ for acceptable performance, determine the minimum value of processing gain. **(06 Marks)**

c. Write a note on code division multiple access as an application of direct sequence spread spectrum. **(03 Marks)**

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CBCS Scheme

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15EC62

Sixth Semester B.E. Degree Examination, June/July 2018
ARM Microcontroller & Embedded Systems

Time: 3 hrs. Max. Marks: 80

Note: ***Answer FIVE full questions, choosing one full question from each module.***

Module-1

1 a. With a neat diagram, explain the architecture of ARM cortex M3 microcontroller. **(10 Marks)**

b. Explain the register organization of Cortex M3. **(06 Marks)**

OR

2 a. Explain the operation modes and privilege levels available in ARM cortex M3 with a neat transition diagram. **(06 Marks)**

b. Mention the instructions used for accessing the special registers. Explain the same using suitable examples. **(04 Marks)**

c. Explain the stack operations using Push and Pop instructions in ARM Cortex M3. **(06 Marks)**

Module-2

3 a. Explain shift and Rotate instructions available in ARM Cortex M3 instruction set. Why is there rotate right instruction but no rotate left instruction in Cortex M3? **(08 Marks)**

b. Explain the following instructions with suitable example:
(i) BFC (ii) SXTH (iii) UBFX (iv) RBIT **(08 Marks)**

OR

4 a. Write the memory map and explain memory access attributes in Cortex M3. **(08 Marks)**

b. Analyse the following instructions and write the contents of the registers after the execution of each instruction:
Assume R8 = 0x00000088, R9 = 0x00000006 and R3 = 0x00001111
(i) RSB.W R8, R9, #0x10
(ii) ADD R8, R9, R3
(iii) BIC.W R6, R8, #0x06
(iv) ORR R8, R9 **(08 Marks)**

Module-3

5 a. Differentiate between:
(i) RISC and CISC architecture.
(ii) Little Endian and Big Endian architecture. **(08 Marks)**

b. What are the features of the following:
(i) I2C bus
(ii) IrDA
(iii) Optocoupler
(iv) 1-wire interface **(08 Marks)**

OR

6 a. What are the different types of memories used in Embedded system design? Explain the role of each. **(08 Marks)**

b. Explain the following circuits in an embedded system :
   (i) Brown-out protection unit.
   (ii) Reset circuit. **(08 Marks)**

Module-4

7 a. Explain the term quality attributes in an embedded system development context. What are the different quality attributes to be considered in an embedded system design. **(08 Marks)**

b. Explain Data flow graph and control data flow graph models in the embedded design. **(08 Marks)**

OR

8 a. Explain the different 'Embedded firmware design' approach in detail. **(08 Marks)**

b. Explain the characteristics of an Embedded system. **(08 Marks)**

Module-5

9 a. Explain the concept of 'deadlock' with a neat diagram. Mention the different conditions which favours a deadlock situation. **(08 Marks)**

b. Write a block schematic of IDE environment for embedded system design and explain their functions in brief. **(08 Marks)**

OR

10 a. Three processes with process IDs P_1, P_2, P_3 with estimated completion time 10, 5, 7 milliseconds respectively enters the ready queue together. A new process P_4 with estimated completion time 2 ms enters the 'Ready' queue after 2 ms. Calculate the waiting time for all the processes and the turn around time for all the processes. Also, calculate the average waiting time and average turn around time. The algorithm used is SJF (Shortest Job First) based preemptive scheduling. Assume all the process contain only CPU operation and no I/O operation are involved. **(08 Marks)**

b. Mention the sequence of operations for embedding the firmware with a programmer and draw the interfacing diagram. **(08 Marks)**

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CBCS SCHEME

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15EC63

Sixth Semester B.E. Degree Examination, June/July 2018
VLSI Design

Time: 3 hrs. Max. Marks: 80

Note: Answer any FIVE full questions, choosing one full question from each module.

Module-1

1 a. Discuss the working of nMOS enhancement mode transistor operation with neat diagrams. **(06 Marks)**

b. Explain the CMOS inverter DC characteristics highlighting the regions of operation. **(10 Marks)**

OR

2 a. With neat diagrams discuss the nMOS fabrication process steps. **(09 Marks)**

b. Explain the following :
(i) Channel length modulation
(ii) Noise Margin **(07 Marks)**

Module-2

3 a. Discuss the CMOS design style with a diagram. **(05 Marks)**

b. Draw the stick diagram for the following using CMOS logic:
(i) $Y = \overline{A + B + C}$ (ii) 2 i/p NAND gate **(05 Marks)**

c. Discuss the different contact cuts with an example to each. **(06 Marks)**

OR

4 a. With a diagram derive an expression for sheet resistance and mention the R_s values of metal, p and n transistor channels for 5 μm technology. **(05 Marks)**

b. Derive an equation for rise time and fall time with respect to CMOS inverter. **(08 Marks)**

c. Draw the circuit and stick diagram for 2 i/p NOR gate using CMOS logic. **(03 Marks)**

Module-3

5 a. Explain the constant field, constant voltage scaling models with a diagram and scaling effect table. **(06 Marks)**

b. Discuss the problems associated in VLSI design. How do you reduce them? **(05 Marks)**

c. Discuss the different bus architectures. **(05 Marks)**

OR

6 a. Discuss the design of a 4-bit adder. **(07 Marks)**

b. With relevant diagram discuss Manchester carry chain operation. **(05 Marks)**

c. Explain the carry select adder with a diagram. **(04 Marks)**

Module-4

7 a. Discuss the programmable logic array with its structure and floor plan. **(05 Marks)**

b. Discuss the architectural issues related to VLSI sub system design. **(06 Marks)**

c. Discuss the design of Data selectors. **(05 Marks)**

OR

8 a. Explain the architecture of field programmable gate array. **(10 Marks)**

b. Discuss the FPGA abstractions with a diagram. **(06 Marks)**

Module-5

9 a. Explain three transistor DRAM with its diagram and stick diagram. **(07 Marks)**

b. Discuss the ASM chart for JK flip flop with its NAND logic arrangement. **(09 Marks)**

OR

10 a. Explain logic verification process with its functional equivalence diagram. **(06 Marks)**

b. Discuss the design for manufacturability. **(06 Marks)**

c. Discuss the Ad-hoc testing. **(04 Marks)**

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CBCS SCHEME

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15EC64

Sixth Semester B.E. Degree Examination, June/July 2018
Computer Communication Networks

Time: 3 hrs. Max. Marks: 80

Note: Answer any FIVE full questions, choosing one full question from each module.

Module-1

1 a. Explain the significance of layers in TCP/IP protocol suite with neat diagram. **(08 Marks)**
b. Illustrate with an example byte stuffing and bit stuffing. **(04 Marks)**
c. Explain briefly four physical topologies of a network. **(04 Marks)**

OR

2 a. Explain ARP operation and ARP packet format with a neat diagram. **(08 Marks)**
b. Describe the operation of STOP and WAIT protocol also FSM for STOP and WAIT protocol. **(08 Marks)**

Module-2

3 a. Explain the three strategies used in CSMA/CA collision avoidance. **(06 Marks)**
b. A pure ALOHA network transmits 200 bit frames on a shared channel of 200 kbps. What is the throughput if the system produces (i) 1000 frames per sec (ii) 500 frames per sec (iii) 250 frames per sec. **(04 Marks)**
c. With a neat diagram explain Ethernet frame format. **(06 Marks)**

OR

4 a. Describe persistence methods in CSMA with flow diagram. **(06 Marks)**
b. Write short notes on 10 Base 5 Ethernet and 10 Base 2 Ethernet. **(06 Marks)**
c. Describe Polling in controlled access method. **(04 Marks)**

Module-3

5 a. Explain Hidden station problem in wireless networks. **(05 Marks)**
b. Describe Spanning Tree Algorithm with an example. **(06 Marks)**
c. Explain Datagram approach in connectionless service to route the packet. **(05 Marks)**

OR

6 a. With a neat diagram describe the two kinds of services defined by wireless architecture. **(05 Marks)**
b. Explain with a neat diagram VLAN, membership and configuration of VLAN. **(06 Marks)**
c. Explain a simple implementation of Network Address Translation (NAT) and address translation with a neat diagram. **(05 Marks)**

Module-4

7 a. Explain IPV4 Datagram format. **(08 Marks)**
b. Explain with an example distance vector routing algorithm. **(08 Marks)**

OR

8 a. Explain with a neat diagram the three phases in Mobile host communication. **(08 Marks)**
b. Explain with an example link state routing and also apply Dijksthra algorithm to find least cost path tree. **(08 Marks)**

Module-5

9 a. Explain why the send window size for Go-Back N must be less than 2^m. **(05 Marks)**

b. Explain sending and receiving buffers in TCP. **(05 Marks)**

c. With a neat diagram explain TCP segment format. **(06 Marks)**

OR

10 a. Explain why the size of the send and receiver window in selective repeat can be atmost one half of 2^m. **(05 Marks)**

b. Discuss the general services provided by UDP. **(05 Marks)**

c. Explain with a neat diagram connection establishment using three way handshaking in TCP. **(06 Marks)**

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CBCS SCHEME

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15EC651

Sixth Semester B.E. Degree Examination, June/July 2018
Cellular Mobile Communication

Time: 3 hrs. Max. Marks: 80

Note: Answer any FIVE full questions, choosing ONE full question from each module.

Module-1

1 a. Explain frequency reuse concept with proper illustrative figure and necessary expressions. **(08 Marks)**

b. Explain how subdividing a congested cell into smaller cells can expand the capacity of cellular systems. **(08 Marks)**

OR

2 a. Explain free space large scale a propagation model used to predict received signal strength when the transmitter and receiver have a clear, unobstructed line-of-sight path between them with necessary expressions. **(10 Marks)**

b. Find the median path loss using Okumura's model for d = 50km, h_{te} = 100m, h_{re} = 10m in a suburban environment. If the base station transmitter radiates an EIRP of 1 KW at a carrier frequency of 900 MHz, find the power at the receiver. (Assume a units gain receiving antenna. A_{mu} (900 MHz (50 km)) = 43dB. G_{AREA} = 9dB). **(06 Marks)**

Module-2

3 a. With detailed explanation, show that time invariant channel impulse response is $h_b(\tau) = \sum_{i=0}^{N-1} a_i \exp(j\theta_i)\ \delta(\tau - \tau_i)$. **(10 Marks)**

b. Calculate the mean excess delay, rms delay spread, and the maximum excess delay (10dB) for the multipath profile shown in Fig.Q3(b). Estimate the 50% coherence bandwidth of the channel. **(06 Marks)**

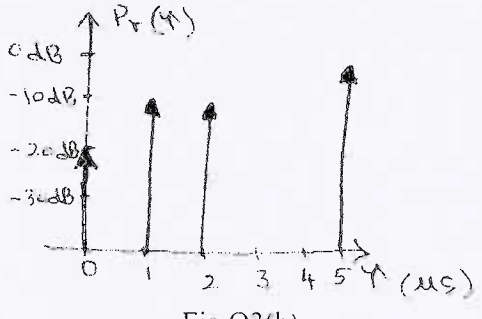

Fig.Q3(b)

OR

4 a. Explain spread spectrum sliding correlator channel sounding system. **(08 Marks)**

b. Explain fading effects due to multipath time delay spread. **(08 Marks)**

Module-3

5 a. Explain the different registers used in GSM system for the management of user data and system securities. **(08 Marks)**

b. Explain various network interfaces in GSM system with diagram. **(08 Marks)**

OR

6 a. Explain how logical channels can be mapped onto the physical channels in time domain. **(08 Marks)**

b. Explain GSM protocol architecture for transparent and non–transparent data transmission. **(08 Marks)**

Module-4

7 a. Explain handover with respect to :
i) Intracell and intercell
ii) Internal and external. **(08 Marks)**

b. Explain MMS network architecture with diagram. **(08 Marks)**

OR

8 a. Explain GPRS system architecture and interfaces with diagram. **(10 Marks)**

b. Write a short note on EDGE concept. **(06 Marks)**

Module-5

9 a. Explain with diagram, typical network nodes found in CDMA2000. **(10 Marks)**

b. With diagram, explain the basic principle behind the use of an 8-bit Walsh orthogonal spreading code to create a distinct signal. **(06 Marks)**

OR

10 a. Explain with the diagram, how reverse CDMA access channels are used by the mobile to answer pages. **(08 Marks)**

b. Explain :
i) Idle handoff
ii) Soft handoff. **(08 Marks)**

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CBCS SCHEME

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15EC654

Sixth Semester B.E. Degree Examination, June/July 2018
Digital Switching Systems

Time: 3 hrs. Max. Marks: 80

Note: *Answer any FIVE full questions, choosing one full question from each module.*

Module-1

1 a. Explain in detail with a neat diagram of different network structures. **(08 Marks)**

b. Draw a neat diagram of four-wire circuit and explain its working. **(08 Marks)**

OR

2 a. Differentiate between TDM and FDM transmission network, with suitable diagrams. **(08 Marks)**

b. Explain in details PDH and SDH with neat diagrams. **(08 Marks)**

Module-2

3 a. Explain in brief distributed systems with neat diagrams. **(08 Marks)**

b. Explain different functions of switching systems. **(08 Marks)**

OR

4 a. Explain in detail building blocks of a digital switching of system. With neat block diagrams. **(08 Marks)**

b. Explain in brief basic call processing with diagrams. **(08 Marks)**

Module-3

5 a. Define the following:
(i) Busy hour (ii) Grade of service (iii) Holding time
(iv) Statistical equilibrium **(08 Marks)**

b. Derive an expression for the second Erlang's distribution starting from basic principles. **(08 Marks)**

OR

6 a. Design a progressive grading system connecting 20 outgoing trunks and having a switch with availability of 10. Draw the grading diagram. **(08 Marks)**

b. Design a three stage network for 100 incoming trunks to 400 outgoing trunks. Draw the diagram. **(08 Marks)**

Module-4

7 a. With a neat sketch, explain space switch in detail. **(08 Marks)**

b. Explain in brief frame alignment with neat sketch. Explain different types of synchronization networks. **(08 Marks)**

OR

8 a. With a neat diagram, explain Level 1, Level 2 and Level 3 control of a digital switching system. **(08 Marks)**

b. What is feature flow diagram? Draw feature flow diagram for feature activation, feature operation and feature deactivation for a call forwarding feature. **(08 Marks)**

Module-5

9 a. Explain the interface of digital switching central office with neat diagram. **(08 Marks)**

b. Highlight the strategy for improving software quality. **(08 Marks)**

OR

10 a. Explain generic switch software and hardware architecture. With respect to suitable diagram. **(08 Marks)**

b. Explain recovery stage of initialization process with examples. **(08 Marks)**

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CBCS SCHEME

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15EC655

Sixth Semester B.E. Degree Examination, June/July 2018
Microelectronics

Time: 3 hrs. Max. Marks: 80

Note: Answer any FIVE full questions, choosing ONE full question from each module.

Module-1

1 a. Derive the expression for drain to source current for triode and saturation regions of n-MOSFET. **(10 Marks)**

b. Design the circuit shown in Fig.Q1(b) to obtain a drain voltage of 0.1V. Find the value of R_D. At the operating point, let $V_t = 0.5V$ and $K_n'\left(\frac{W}{L}\right) = 2mA/V^2$. **(06 Marks)**

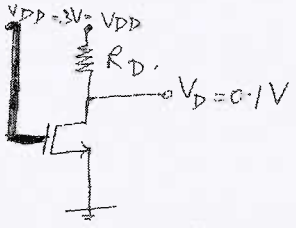

Fig.Q1(b)

OR

2 a. Derive the expression for drain current under channel length modulation. **(08 Marks)**

b. What is body effect? Write the expressions for V_t related to body effect and draw its small signal model. **(04 Marks)**

c. Design the circuit in Fig.Q2(c) to obtain $I_D = 80\ \mu A$, find the value required for R and find the DC voltage V_D. Let the NMOS transistor have $V_t = 0.6V$, $\mu_n cox = 200\ \mu A/V^2$, $L = 0.8\mu m$ and $W = 4\ \mu m$. Neglect channel length modulation. **(04 Marks)**

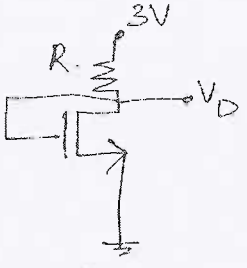

Fig.Q2(c)

Module-2

3 a. Briefly explain any two types of baising methods in MOS amplifier circuits. **(06 Marks)**

b. Derive the expression for transconductance gm and voltage gain Av for a CS amplifier with small input signal. **(10 Marks)**

OR

4 a. Develop a T equivalent model for the MOSFET from a hybrid π model. **(08 Marks)**

b. For a n-channel MOSFET with $t_{ox} = 10nm$, $L = 1.0\mu m$, $W = 10\mu m$, $L_{OV} = 0.05\mu m$, $C_{sbo} = C_{dbo} = 10fF$, $V_0 = 0.6V$, $V_{SB} = 1\ V$ and $V_{DD} = 2V$. Calculate the following capacitances when the transistor is operating in saturation C_{OX}, C_{OV}, C_{gs}, C_{gd}, C_{db}, C_{sb}. Given $E_{OX} = 3.45 \times 10^{-11}\ F/m^2$. **(08 Marks)**

Module-3

5 a. Make a comparison between BJT and MOSFET (Any 4 characteristics). **(08 Marks)**

b. Determine the G_V, A_y, R_{out}, R_{in}, A_{VO} for a common source MOS amplifier without source degeneration. **(08 Marks)**

OR

6 a. Explain the operation of a MOS current steering circuit and mention its advantage. **(08 Marks)**

b. Consider CG amplifier designed using a circuit. Given g_m = 1mA/V and R_D= 15 kΩ. Find R_{in}, R_{out}, A_V, A_{VO}, and G_V for R_L = 15kΩ and R_{sig} = 50Ω. **(08 Marks)**

Module-4

7 a. A CMOS CS amplifier fabricated in 0.18μm technology has W/L = 7.2μm/0.36μm for all transistor K'_n=387μA/V^2, K'_p = 86 μA/V^2, I_{ref} = 100μA, V'_{An} = 5V/μm and $|V_{AP}|$ = 6V/μm. Find g_{m_1}, r_{o_1}, r_{o_2} and voltage gain. **(08 Marks)**

b. For a CG amplifier with active load determine the expression for R_i, A_{VO}, A_V, G_{VO}, G_V, R_O. **(08 Marks)**

OR

8 a. Write a notes on : i) Double cascode ii) Folded cascode. **(08 Marks)**

b. Explain CMOS implementation of common source amplifier. **(08 Marks)**

Module-5

9 a. For a MOS differential pair with a common mode voltage V_{CM} is shown in Fig. Q9 (a). Let $V_{DD} = V_{SS} = 1.5V$, $K'_n\left(\frac{W}{L}\right) = 4mA/V^2$, $V_t = 0.5V$, I = 0.4 mA and R_D = 2.5kΩ. Neglect channel length modulation.

i) Find V_{OV} and V_{GS} for each transistor

ii) For V_{CM} = 0, find V_S, id, id_2, Vd_1 and Vd_2

iii) Repeat (b) for V_{CM} = +1V

iv) What is the highest value for which Q_1 and Q_2 are in saturation? If current I requires a minimum voltage of 0.4V to operate properly. What is the lowest allowed V_S and hence V_{CM}? **(10 Marks)**

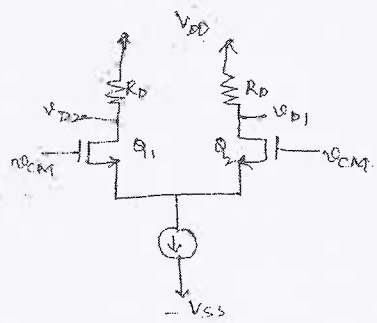

Fig.Q9(a)

b. What is the effect of mismatch of R_D on CMRR of a MOS differential amplifier? **(06 Marks)**

OR

10 a. Explain the operation of MOS differential pair with a differential input signal. **(08 Marks)**

b. Explain 2–stage CMOS OPAMP configuration. **(08 Marks)**

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10EC/TE61

Sixth Semester B.E. Degree Examination, June/July 2018

Digital Communication

Time: 3 hrs. Max. Marks:100

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

PART – A

1 a. Discuss in brief advantages and disadvantages of digital communication over analog communication. **(08 Marks)**

b. Specify the types of digital communication channels. Compare coaxial cable and optical fiber cable. **(06 Marks)**

c. A signal $g(t) = 10\cos(20\pi t)\cos(200\pi t)$ is sampled at a rate of 250 samples/sec.
   i) Sketch spectrum of the sampled signal.
   ii) Specify cut-off frequency of reconstruction filter.
   iii) Specify the Nyquist rate. **(06 Marks)**

2 a. Explain the three basic functions of a Regenerative Repeater in a PCM system with a neat block diagram. **(06 Marks)**

b. 24 Analog signals, each having a bandwidth of 10 kHz are to be time division multiplexed and transmitted via PAM/AM. A guard band of 5 kHz is required for signal transmission from the PAM samples of each signal:
   i) Determine the sampling rate for each signal.
   ii) Transmission Band width. **(04 Marks)**

c. What is meant by Robust quantization? Derive the equation for Variance of quantization Error (σ_Q^2) from the basic principle of Non-uniform quantizer. **(10 Marks)**

3 a. A 10 kHz sinusoid with arc amplitude level of ±1V is to be sampled and quantized by rounding off. How many numbers of bits are required to ensure a quantization SNR of 45 dB? What is the Bit rate of the digital signal? If the sampling Rate is twice the Nyquist Rate. **(04 Marks)**

b. With a neat diagram, explain the concept of digital hierarchy in a Multiplexer. **(08 Marks)**

c. Consider a binary sequence with the values +a for symbol 1 and –a for symbol 0, with +a and –a are equiprobable. Determine the power spectral density for NRZ polar format and plot the spectra. **(08 Marks)**

4 a. Explain in brief with a neat diagram the concept of baseband data transmission. **(10 Marks)**

b. For the input binary data 1011101, obtain the output pre-coder and output duobinary coder. Explain how data can be detected at the Receiver. **(06 Marks)**

c. Explain in brief with a neat diagram adaptive equalization. **(04 Marks)**

PART – B

5 a. Explain with a neat diagram working of (i) coherent BPSK (ii) QPSK transmitter. **(10 Marks)**

b. A binary data is transmitted using ASK over AWGN channel at a rate of 2.4 Mbps. The carrier amplitude at the Receiver is 1 mv. Noise P.S.D $\left(\frac{N_0}{2}\right) = 10^{-15}$ Watts/Hz. Find the Average Probability of Error if the detector is coherent, Erfc(5) = 3×10^{-6}. **(06 Marks)**

c. A binary data stream is encoded using DPSK. Determine the encoded and decoded output for the sequence 101101100. **(04 Marks)**

6 a. Define conceptual model of a digital communication system. **(08 Marks)**

b. Prove the Gram-Schmidt orthogonalization procedure. **(12 Marks)**

7 a. State and prove properties of the matched filter. **(10 Marks)**

b. Explain with a neat diagram, Correlation Receiver. **(10 Marks)**

8 Write short notes on any FOUR:

a. Generation of PN sequence with example

b. DSSS transmitter and receiver

c. Fast and slow frequency hopping

d. Applications of spread spectrum

e. PN sequences and their properties. **(20 Marks)**

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10EC62

Sixth Semester B.E. Degree Examination, June/July 2018
Microprocessors

Time: 3 hrs. Max. Marks:100

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

PART – A

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

b. What is addressing mode? Explain the different addressing mode of 8086? Explain each with examples. **(10 Marks)**

2 a. Explain the following instructions :
i) LEA ii) IDIV iii) DAA iv) JNGE v) SHR. **(10 Marks)**

b. Explain various instruction formats used in 8086 with suitable example. **(10 Marks)**

3 a. Explain the following instructions with examples :
i) MOVS B ii) CMPS B iii) SCAS B iv) repeat prefix (REP) v) LODS. **(10 Marks)**

b. Write a 8086 procedure to convert packed BCD Number in AL to ASCII equivalent in AX. **(06 Marks)**

c. Compare procedure and macro. **(04 Marks)**

4 a. Explain atleast FIVE dedicated interrupts in 8086. **(10 Marks)**

b. What are hardware interrupts of 8086? Write the interrupt priority of 8086. **(05 Marks)**

c. Explain the software interrupt operation of 8086. **(05 Marks)**

PART – B

5 a. Write a keyboard procedure that scans the keyboard (4×4 matrix) and returns with numeric code of the key in AL. **(10 Marks)**

b. Explain the interfacing of a steppermotor to 8086 with necessary circuit diagram. Write an ALP to rotate the stepper motor clockwise by one complete rotation and anticlockwise by one complete rotation. **(10 Marks)**

6 a. Explain the data types of Numeric data processor 8087. **(10 Marks)**

b. Explain the function of the following instructions :
i) FCOMP ii) FENI iii) FDECSTP iv) FSTENV v) FYL2XP1 **(10 Marks)**

7 a. With a block diagram, explain the maximum mode of operation of 8086. **(10 Marks)**

b. Write a note on USB. **(10 Marks)**

8 a. List the different registers in 80386. **(08 Marks)**

b. Explain basic features of Pentium processor. **(06 Marks)**

c. List the features of 80386 processor. **(06 Marks)**

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10EC63

Sixth Semester B.E. Degree Examination, June/July 2018
Microelectronic Circuits

Time: 3 hrs. Max. Marks:100

Note: ***Answer any THREE full questions from Part-A and any TWO full questions from Part-B.***

PART – A

1 a. Discuss the VI characteristics of the n-MOSFET in different regions by deriving i_D - V_{DS} relationship equation. **(12 Marks)**

b. Consider the circuit given in Fig.Q1(b). Let the voltage V_D be applied to the gate of another transistor for Q_2 as shown in Fig.Q1(b). Assume Q_1 and Q_2 are identical and $\lambda = 0$. Find the drain current and voltage of Q_2 and R at Q_1. Let $V_{DD} = 5V$, $V_t = 0.6V$, $\mu_n C_{ox} = 200\ \mu A/V^2$, $L = 0.8\ \mu m$, $\omega = 4\ \mu m$, $V_{OV} = 0.4\ V$. **(08 Marks)**

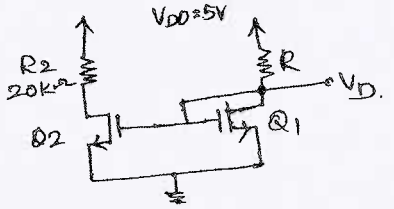

Fig.Q1(b)

2 a. Characterize the common source single stage amplifier with and without source degeneration circuit by deriving the amplifier parameters of R_{in}, V_i, V_o, A_V, A_{VO}, R_{out} and G_{VO}. **(10 Marks)**

b. Consider the circuit given in below Fig.Q2(b) to establish a dc current of $I_D = 0.5$ mA. The MOSFET is specified to have $V_t = 1$ V, $K'W/L = 1$ mA/V^2. Let $\lambda = 0$, $V_{DD} = 15V$. If instead of given circuit fixed – Vgs bias circuit is used then find the value of required Vgs to establish $I_D = 0.5$ mA. Calculate in both the type of biasing circuits the percentage change in the value of I_D obtained when MOSFET is replaced with another unit having the same K(W/L) but $V_t = 1.5V$. [Hint : Choose R_D and R_S to provide 1/3 of V_{DD} as a drop across them]. **(10 Marks)**

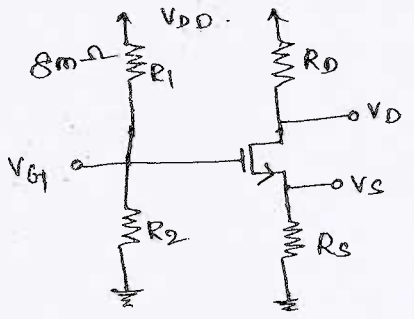

Fig.Q2(b)

3 a. What do you understand about current steering process? Draw and explain a BJT current steering circuit to generate number of constant currents of various magnitudes. **(07 Marks)**

b. What are the different short channel effects? **(05 Marks)**

c. For the given circuit in Fig.Q3(c) find the width of all the transistors. Let $V_{DD} = V_{SS} = 3V$, $V_{tn} = 0.6V$, $V_{tp} = -0.6V$, and all the channel length $L = 1\ \mu m$, $K_n = 200\ \mu A/V^2$, $K_P = 80\ \mu A/V^2$, $I_{ref} = 10\ \mu A$, $I_2 = 80\ \mu A$, $I_3 = 40\mu A$, $I_5 = 70\ \mu A$, and $\lambda = 0$. The required voltage at the drain of Q_2 allowed to go down to within 0.3V of negative supply and that the voltage at the drain of Q_5 be allowed to go upto 0.2 V of the positive supply. **(08 Marks)**

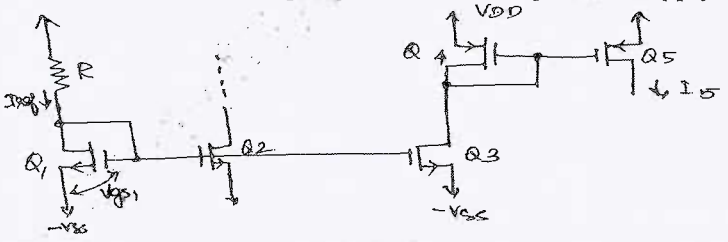

Fig.Q3(c)

4 a. Draw the circuit of common gate amplifier with its active loads. Discuss the small signal analysis and high frequency response. **(10 Marks)**

b. What are two different parameters that decides the performance of the current mirror. Explain the BJT Wilson current mirror circuit and compare it with cascode current mirror. **(06 Marks)**

c. Design Widler current source circuit for generating a constant current $I_o = 10\ \mu A$ which operate from a 10V supply. Determine the values of the required resistors assuming V_{BE} is 0.7 V at a current of 1 mA and neglecting the effect of finite β. **(04 Marks)**

5 a. Draw the circuit diagram and different stages of two stage CMOS op-amp and explain its structure with all its parameters. **(10 Marks)**

b. Discuss the large signal and small signal operation of the MOS differential pair. **(10 Marks)**

PART – B

6 a. Explain the different amplifiers to describe the four different feedback topologies. **(10 Marks)**

b. What do you understand about the frequency compensation method of an amplifier to maintain stability for desired value of gain? **(10 Marks)**

7 a. What are the different non-linear functional op-amp circuits? Explain them by deriving the expression for its output voltage. **(10 Marks)**

b. What are the limitations on the performance of op-amp circuits at large o/p signals? **(07 Marks)**

c. Design an inverting amplifier using op-amp having a gain of – 10 and input resistance of 100 kΩ. **(03 Marks)**

8 a. Implement the CMOS logic circuit for the expression $y = A + B(C + DE)$. Provide the W/L ratios of all n-transistor in your circuit, with proper transistor sizing. Assume that for the basic inverter $n = 2$ and $p = 5$ and that the channel length is 0.18 μm. **(08 Marks)**

b. Design a level restored n-pass transistor logic circuit for the given expression $Y = A + BC$. Explain the concept of level restoration using your own circuit. **(06 Marks)**

c. Consider a CMOS inverter fabricated in a 0.25 μm process for which $C_{ox} = 6\ fF/\mu m^2$, $\mu_n C_{ox} = 115\ \mu A/V^2$, $\mu_p C_{ox} = 30\ \mu A/V^2$, $V_{th} = -V_{tp} = 0.4$ V and V_{DD} 2.5 V. The W/L ratio of Q_N is $\frac{0.375\mu m}{0.25\mu m}$, and that for Q_p is $\frac{1.125\mu m}{0.25\mu m}$. The gate-source and gate-drain overlap capacitances are specified to be 0.3 fF/μm of gate width. Further the effective value of drain body capacitances are $C_{dbn} = 1$ fF and $C_{dbp} = 1$ fF. The wiring capacitance $C_W = 0.2$ fF. Find propagation delay t_p. **(06 Marks)**

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10EC64

Sixth Semester B.E. Degree Examination, June/July 2018
Antenna and Propagation

Time: 3 hrs. Max. Marks:100

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

PART – A

1 a. Define the following terms as related to antenna system:
i) HPBW
ii) Power density
iii) Beam solid angle
iv) Directivity
v) Radiation resistance **(10 Marks)**

b. Calculate the exact directivity for the following sources:
i) $u = u_m \sin^2\theta \sin^3\phi$ ii) $u = u_m \sin\theta \sin^3\phi$
u has value only for $0 \le \theta \le \pi$ and $0 \le \phi \le \pi$ and is zero elsewhere. **(05 Marks)**

c. Define antenna aperture. Derive the relationship between aperture and beam area. **(05 Marks)**

2 a. State and explain power theorems in terms of power density and radiation intensity. **(05 Marks)**

b. Obtain the relative field pattern for an array of two isotropic point sources of same amplitude and opposite phase spaced $\lambda/2$ apart. **(10 Marks)**

c. Find the total power radiated and directivity of an antenna with radiation intensity. $u = u_m \cos^4\theta \sin^{-2}\phi$ for $0 \le \theta \le \pi/2$ and $0 \le \phi \le 2\pi$. **(05 Marks)**

3 a. Write an explanatory note on folded dipole antenna with neat figure. **(06 Marks)**

b. Show that the radiation resistance of $\lambda/2$ antenna is 73Ω. **(09 Marks)**

c. For a short dipole $\lambda/15$ long, find the efficiency, radiation resistance if loss resistance is 1Ω. Find also the effective aperture. **(05 Marks)**

4 a. Write a brief note on patch antenna. **(05 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. **(06 Marks)**

c. What are the salient features of loop antenna? Obtain radiation resistance of a small loop antenna. **(09 Marks)**

PART – B

5 a. With a neat diagram, explain the working of yagi-uda antenna in detail with design formulae. Highlight its applications. **(08 Marks)**

b. A dish antenna operating at a frequency of 1.43GHz has a diameter of 64 metres and is fed by a directional antenna. Calculate HPBW, BWFN and gain with respect to $\lambda/2$ dipole with even illumination. **(05 Marks)**

c. Explain helical antenna with design considerations and working principle. Also highlight the applications of the antenna. **(07 Marks)**

6 a. Briefly write about various types of horn antennas with neat diagrams. **(05 Marks)**

b. Explain the working of log periodic antenna. **(05 Marks)**

c. Write short notes on:

i) Embedded antenna

ii) Ultra wide band antenna. **(10 Marks)**

7 a. Derive an expression for 'Line of Sight' distance (LOS) between transmitting and receiving antennas. **(06 Marks)**

b. Define wave tilt of a surface wave propagation. Also, prove that wave tilt,

$$\alpha = \tan^{-1}\frac{E_n}{E_t} = \tan^{-1}\left[\frac{1}{\sqrt{\epsilon_1}}\cdot\frac{1}{[1+x^2]^{1/4}}\right].$$ **(10 Marks)**

c. Explain duct propagation in brief. **(04 Marks)**

8 a. Define the following as related to ionospheric propagation with standard formulaes:
i) Virtual height ii) Critical frequency iii) Maximum usable frequency. **(09 Marks)**

b. Calculate the value of frequency at which the electromagnetic wave should be propagated in D-region given that refractive index $\mu = 0.5$ and electron density $\gamma = 10^{12}$ electrons/m^3. **(05 Marks)**

c. In an ionospheric wave propagation, the angle of incidence made at a particular layer at the height of 200km is 45°, with critical frequency 6MHz. Calculate the skip distance. **(06 Marks)**

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06EC64

Sixth Semester B.E. Degree Examination, June/July 2018
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 the following terms with respect to an antenna : (i) Beamwidth (ii) Beam area (iii) Directivity and gain. **(12 Marks)**

b. Show that the maximum effective aperture of a $\frac{\lambda}{2}$ dipole is $0.13\lambda^2$. **(05 Marks)**

c. An antenna has a field pattern given by $E(\theta) = \cos\theta \cos 2\theta$ for $0 \le \theta \le 90$. Find
(i) the half power beamwidth (HPBW) and
(ii) the beamwidth between first nulls (FNBW) **(03 Marks)**

2 a. Derive an expression for the total field in case of two isotropic point sources with same amplitude & phase. Plot the field pattern for two isotropic point sources spaced $\frac{\lambda}{2}$ apart. **(10 Marks)**

b. Derive the directivity for the following sources : (i) Unidirectional cosine squared power pattern. (ii) Bidirectional sine squared power pattern. **(10 Marks)**

3 a. Explain the principle of pattern multiplication with an example. **(08 Marks)**

b. Show that the width of the principle lobe of a uniform end-fire array is greater than that of a uniform broad-side away. **(08 Marks)**

c. Using exact method, calculate the distance between the elements of broadside array whose beamwidth between first null is found to be 45° at a frequency of 10 MHz. There are 8 elements in the array. **(04 Marks)**

4 a. Show that the radiation resistance of a $\frac{\lambda}{2}$ antenna is 73 ohms. **(08 Marks)**

b. Write a note on : (i) Rhombic antenna. (ii) Folded dipole antenna. **(12 Marks)**

PART – B

5 a. Explain the Babinet's principle with illustrations. Discuss features of complementary antenna. **(10 Marks)**

b. Write a note on horn antenna and loop antenna. **(10 Marks)**

6 a. Explain the practical design considerations for the monofilar axial helical antenna. **(10 Marks)**

b. Write a note on: (i) Turnstile antenna. (ii) Embedded antenna **(10 Marks)**

7 a. Explain the factors affecting the propagtation of radio waves in an actual environment. Discuss the salient features of ground wave propagation. **(08 Marks)**

b. What is diffraction? What are the different kinds of diffraction models? Explain the knife edge diffraction model. **(08 Marks)**

c. A transmit and a receive antenna are separated by a distance of 100λ. A knife edge obstacle located exactly mid-way between the two antennas is obstructing the line-of-sight propagation path. What should be the distance between the tip of the obstacle and the line-of-sight path so that the knife-edge diffraction gain is 1.37 dB. Take $V_d = -1.22$. **(04 Marks)**

8 a. Define the following terms:- (i) Muf (ii) Critical frequency. **(06 Marks)**

b. In an ionospheric wave propagation, the angle of incidence made at a particular layer at a height of 200 km is 45° with critical frequency of 6 MHz. Calculate the skip distance. **(04 Marks)**

c. Write a note on: (i) Faraday rotation (ii) Electron density profiles of ionosphere **(10 Marks)**

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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.

CBCS Scheme

USN | | | | | | | | | | 15EC52

Fifth Semester B.E. Degree Examination, Dec.2017/Jan.2018
Digital Signal Processing

Time: 3 hrs. Max. Marks: 80

Note: Answer any FIVE full questions, choosing ONE full question from each module.

Module-1

1 a. Define DFT and IDFT of a signal obtain the relationship between of DFT and z – transform. **(06 Marks)**

b. Compute circular convolution using DFT and IDFT for the following sequences, $x_1(n) = \{2, 3, 1, 1\}$ and $x_2(n) = \{1, 3, 5, 3\}$. **(10 Marks)**

OR

2 a. The first five samples of the 8 – point DFT x(k) are given as follows :
$x(0) = 0.25$, $x(1) = 0.125 - j0.3018$, $x(4) = x(6) = 0$, $x(5) = 0.125 - j0.0518$. Determine the remaining samples, if the x(n) is real valued sequence. **(04 Marks)**

b. State and prove the circular time shift and circular frequency shift properties. **(06 Marks)**

c. If $x(n) = \{1, 2, 0, 3, -2, 4, 7, 5\}$, evaluate the following :

i) x(0) ii) x(4) iii) $\sum_{n=0}^{7} x(k)$. **(06 Marks)**

Module-2

3 a. State and prove the following properties of phase factor ω_N.
i) periodicity
ii) symmetry. **(04 Marks)**

b. Find the output y(n) of a filter whose impulse suppose $h(n) = \{1, 2, 3, 4\}$ and input signal to the filter is $x(n) = \{1, 2, 1, -1, 3, 0, 5, 6, 2, -2, -5, -6, 7, 1, 2, 0, 1\}$ using overlap – add method with 6-point circular convolution. **(12 Marks)**

OR

4 a. In the direct computation of N-point DFT of x(n), how many :
i) Complex additions
ii) Complex multiplications
iii) Real multiplication
iv) Real additions
v) Trigonometric functions
Evaluations are required? **(06 Marks)**

b. Explain the linear filtering of long data sequences using overlap – save method. **(10 Marks)**

Module-3

5 a. Given $x(n) = \{1, 0, 1, 0\}$, find x(2) using Goertzel algorithm. **(06 Marks)**

b. Find the 8-point DFT of the sequence $x(n) = \{1, 2, 3, 4, 4, 3, 2, 1\}$ using DIT – FFT radix – 2 algorithm. **(10 Marks)**

OR

6 a. What is chirp–z transform? Mention its applications? **(06 Marks)**

b. Find the 4-point circular convolution of x(n) and h(n) give below, using radix–2. DIF–FFT algorithm.
$x(n) = \{1, 1, 1, 1\}$
$h(x) = \{1, 0, 1, 0\}$. **(10 Marks)**

Module-4

7 a. Derive an expression for the order, cut of frequency and poles of the low pass Butterworth filter. **(08 Marks)**

b. A Butterworth low pass filter has to meet the following s specifications.
i) Pass band gain, $k_p = -1$dB at $\Omega_p = 4$ rad/sec
ii) Step band alternations greater than or equal to 20dB at $\Omega_s = 8$rad/sec
Determine the transfer function $H_a(s)$ of the Butterworth filter to meet the above specifications. **(08 Marks)**

OR

8 a. A third –order Butterworth low pass filter has the transfer function :

$$H(s) = \frac{1}{(s+1)(s^2+s+1)}$$

Design H(z) using impulse invariant technique. **(10 Marks)**

b. List the advantages and disadvantages of IIR filters. **(06 Marks)**

Module-5

9 a. A linear time – invariant digital IIR filter is specified by the following transfer function :

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

Realize the system in the following forms : i) direct form – I ii) Direct form –II. **(12 Marks)**

b. Obtain a cascade realization for the system function given below :

$$H(z) = \frac{\left(1+z^{-1}\right)^3}{\left(1-\frac{1}{4}z^{-1}\right)\left(1-z^{-1}+\frac{1}{2}z^{-2}\right)}.$$ **(04 Marks)**

OR

10 a. Explain the following terms :
i) Rectangular window
ii) Bartlett window
iii) Hamming window. **(08 Marks)**

b. A filter is to be designed with the following desired frequency response :

$$H_d(\omega) = \begin{cases} 0, & -\pi/4 < \omega < \pi/4 \\ e^{-j2\omega}, & \pi/4 < |\omega| < \pi \end{cases}$$

Find the frequency response of the FIR filter designed using rectangular window defined below :

$$\omega_R(n) = \begin{cases} 1, & 0 \le n \le 4 \\ 0, & \text{otherwise} \end{cases}.$$ **(08 Marks)**

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CBCS SCHEME

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15EC53

Fifth Semester B.E. Degree Examination, Dec.2017/Jan.2018
Verilog HDL

Time: 3 hrs. Max. Marks: 80

Note: Answer any FIVE full questions, choosing one full question from each module.

Module-1

1 a. Explain a typical design flow for designing VLSI IC circuit using the block diagram. **(06 Marks)**

b. Explain top down design methodology and bottom up design methodology. **(10 Marks)**

OR

2 a. With a block diagram of 4-bit Ripple carry counter, explain the design hierarchy. **(10 Marks)**

b. Explain the trends in Hardware Description Languages (HDLs). **(06 Marks)**

Module-2

3 a. With a neat block diagram, explain the components of verilog module. **(06 Marks)**

b. Explain the following data types with an example in verilog:
(i) Nets (ii) Register (iii) Integers (iv) Real (v) Time Register. **(10 Marks)**

OR

4 a. Explain the port connection rules. **(06 Marks)**

b. Explain the two methods of connecting ports to external signals with an example. **(10 Marks)**

Module-3

5 a. What are Rise, Fall and Turn-off delays? How they are specified in verilog? **(06 Marks)**

b. Design a 2-to-1 multiplexer using bufifo and bufifl gates. The delay specification for these gates are as follows:

Delay	Min	Typ	Max.
Rise	1	2	3
Fall	3	4	5
Turn-off	5	6	7

Write gate level description and stimulus in verilog. **(10 Marks)**

OR

6 a. Write a verilog dataflow level of abstraction for 4-to-1 multiplexer using conditional operator. **(06 Marks)**

b. Write a verilog dataflow description for 4-bit Full adder with carry lookahead. **(10 Marks)**

Module-4

7 a. Explain the blocking assignment statements and non-blocking assignment statements with relevant examples. **(08 Marks)**

b. Write a note on the following loop statements:
(i) While loop (ii) forever loop. **(08 Marks)**

OR

8 a. Explain sequential and parallel blocks with examples. **(08 Marks)**

b. Write a verilog program for 8-to-1 multiplexer using case statement. **(08 Marks)**

Module-5

9 a. Explain the synthesis process with a block diagram. **(08 Marks)**

b. Write a VHDL program for two 4-bit comparator using data flow description. **(08 Marks)**

OR

10 a. Explain the declaration of constant, variable and signal in VHDL with example. **(08 Marks)**

b. Write a VHDL program for half adder in behavioral description. **(08 Marks)**

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CBCS Scheme

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15EC54

Fifth Semester B.E. Degree Examination, Dec.2017/Jan.2018
Information Theory and Coding

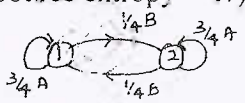
Time: 3 hrs. Max. Marks: 80

Note: *Answer FIVE full questions, choosing any one full question from each module.*

Module-1

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

b. For the Markov source shown below, find i) The stationary distribution ii) State entropies iii) Source entropy iv) G_1 G_2 and show that $G_1 \geq G_2 \geq H(s)$. **(10 Marks)**



c. Define Self Information, Entropy and Information rate. **(03 Marks)**

OR

2 a. Mention different properties of entropy and prove external property. **(07 Marks)**

b. A source emits one of the four symbols S_1 S_2 S_3 and S_4 with probabilities of $\frac{7}{16}$, $\frac{5}{16}$, $\frac{1}{8}$ & $\frac{1}{8}$. Show that $H(S^2) = 2H(S)$. **(04 Marks)**

c. In a facsimile transmission of a picture, there are about 2.25×10^6 pixels/frame. For a good reproduction at the receiver 12 brightness levels are necessary. Assume all these levels are equally likely to occur. Find the rate of information if one picture is to be transmitted every 3 min. Also compute the source efficiency. **(05 Marks)**

Module-2

3 a. A discrete memory less source has an alphabet of five symbols with their probabilities as given below : **(10 Marks)**

Symbol	S_0	S_1	S_2	S_3	S_4
Probabilities	0.55	0.15	0.15	0.1	0.05

Compute Huffman code by placing composite symbol as high as possible and by placing composite symbol as low as possible. Also find i) The average codeword length ii) The variance of the average code word for both the cases.

b. Using Shannon Fano – coding, find code words for the probability distribution $P = \left\{\frac{1}{2}, \frac{1}{4}, \frac{1}{8}, \frac{1}{8}\right\}$. Find average code word length and efficiency. **(06 Marks)**

OR

4 a. Write a short note on Lempel Ziv algorithm. **(05 Marks)**

b. Derive Source coding theorem. **(05 Marks)**

c. Apply Shannon's encoding algorithm and generate binary codes for the set of messages given below. Also find variance, code efficiency and redundancy. **(06 Marks)**

M_1	M_2	M_3	M_4	M_5
1/8	1/16	3/16	1/4	3/8

Module-3

5 a. Find the capacity of the discrete channel whose noise matrix is **(04 Marks)**

$$P\left(\frac{y}{x}\right) = \begin{bmatrix} 0.8 & 0.2 & 0 \\ 0.1 & 0.8 & 0.1 \\ 0 & 0.2 & 0.8 \end{bmatrix}$$

b. Define Mutual Information. List the properties of Mutual information and prove that $I(x : y) = H(x) + H(y) - H(xy)$ bits/system. **(06 Marks)**

c. A channel has the following characteristics :

$$P\left(\frac{y}{x}\right) = \begin{bmatrix} \frac{1}{3} & \frac{1}{3} & \frac{1}{6} & \frac{1}{6} \\ \frac{1}{6} & \frac{1}{6} & \frac{1}{3} & \frac{1}{3} \end{bmatrix} \text{ \& } P(x_1) = p(x_2) = \frac{1}{2}.$$ Find H(x) , H(y) , H(x, y) and Channel capacity if r =1000 symbols/sec. **(06 Marks)**

OR

6 a. A binary symmetric channel has the following noise matrix with source probabilities of

$$P(x_1) = \frac{2}{3} \text{ and } P(x_2) = \frac{1}{3} \text{ and } P\left(\frac{y}{x}\right) = \begin{bmatrix} \frac{3}{4} & \frac{1}{4} \\ \frac{1}{4} & \frac{3}{4} \end{bmatrix}.$$ **(08 Marks)**

i) Determine H(x) , H(y) , H(x, y) , H(y/x) , H(x/y) and I(x, y).

ii) Find channel capacity C. iii) Find channel efficiency and redundancy.

b. Derive an expression for channel efficiency for a Binary Erasure channel. **(05 Marks)**

c. Write a note on Differential Entropy. **(03 Marks)**

Module-4

7 a. For a systematic (6,3) linear block code generated by $C_4 = d_1 \oplus d_3$, $C_5 = d_2 \oplus d_3$, $C_6 = d_1 \oplus d_2$.

i) Find all possible code vectors ii) Draw encoder circuit and syndrome circuit

iii) Detect and correct the code word if the received code word is 110010.

iv) Hamming weight for all code vector, min hamming distance. Error detecting and correcting capability. **(14 Marks)**

b. Define the following : i) Block code and Convolutional code ii) Systematic and non – systematic code. **(02 Marks)**

OR

8 a. A linear Hamming code for (7, 4) is described by a generator polynomial $g(x) = 1 + x + x^3$. Determine Generator Matrix and Parity check matrix. **(03 Marks)**

b. A generator polynomial for a (15, 7) cyclic code is $g(x) = 1 + x^4 + x^6 + x^7 + x^8$.

i) Find the code vector for the message $D(x) = x^2 + x^3 + x^4$. Using cyclic encoder circuit.

ii) Draw syndrome calculation circuit and find the syndrome of the received polynomial $Z(x) = 1 + x + x^3 + x^6 + x^8 + x^9 + x^{11} + x^{14}$. **(13 Marks)**

Module-5

9 a. Consider the (3, 1, 2) convolutional code with $g_1 = 110$, $g_2 = 101$, $g_3 = 111$. **(12 Marks)**

i) Draw the encoder block diagram ii) Find the generator matrix

iii) Find the code word corresponding to the information sequence 11101 using time domain and transform Domain approach.

b. Write short note on BCH code. **(04 Marks)**

OR

10 For a (2, 1, 3) convolutional encoder with $g_1 = 1011$, $g_2 = 1101$. **(16 Marks)**

a. Draw the state diagram b. Draw the code tree.

c. Draw trellis diagram and code word for the message 1 1 1 0 1.

d. Using Viterbi decoding algorithm decode the obtained code word if first bit is erroneous.

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CBCS Scheme

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15EC552

Fifth Semester B.E. Degree Examination, Dec.2017/Jan.2018
Switching and Finite Automata Theory

Time: 3 hrs. Max. Marks: 80

Note: Answer any FIVE full questions, choosing one full question from each module.

Module-1

1 a. Discuss the following :
   i) Threshold element
   ii) Admissible pattern. **(08 Marks)**

b. Show that a threshold logic realization of a full adder requires only tow threshold elements. (Note: both sum and carryout must be generated). **(08 Marks)**

OR

2 a. By examining the linear inequalities, determine which of the following functions is a threshold function, and for each one that is, find the corresponding weight – threshold vector.
   i) $f_1(x_1, x_2, x_3) = \Sigma(1,2,3,7)$
   ii) $f_2(x_1, x_2, x_3) = \Sigma(0,2,4,5,6)$
   iii) $f_3(x_1, x_2, x_3) = \Sigma(0,3,5,6)$ **(10 Marks)**

b. Explain the concept of Geometrical representation with an example. **(06 Marks)**

Module-2

3 a. Write a note on :
   i) Preset experiments
   ii) Adaptive experiments. **(08 Marks)**

b. For the circuit of Fig. Q3 (b), find all tests to detect the faults x_3, S – a – 0 and S – a – 1.

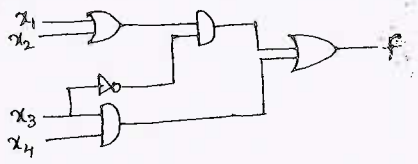
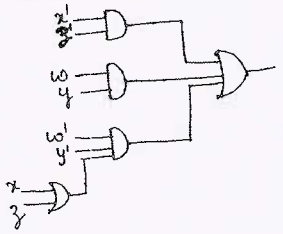


Fig Q.3(b) **(08 Marks)**

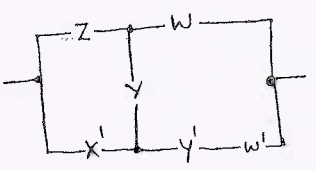
OR

4 a. Explain Fault detection of path sensitizing and list its limitation. **(08 Marks)**

b. Analyse each of the circuits shown in Fig. Q4 (b) i and ii for static hazards. Redesign each circuit so that it becomes hazard – free.



i)



ii)

Fig. Q4(b) **(08 Marks)**

Module-3

5 a. What are compatible states? For the tabular column Table Q5(a), shown machine 'M', find the augmented machine and corresponding minimal machines.

PS	NS, Z	
	X = 0	X = 1
A	A, 0	C, 0
B	B, 0	B, -
C	B, 0	A, 1

Table Q5 (a) M **(10 Marks)**

b. Discuss closed set of compatibility. **(06 Marks)**

OR

6 a. What is merger graph? Draw the merger graph for the incompletely specified machine M_1 shown in Table Q6 (a).

PS	NS, Z			
	I_1	I_2	I_3	I_4
A	-	C, 1	E, 1	B, 1
B	E, 0	-	-	-
C	F, 0	F, 1	-	-
D	-	-	B, 1	-
E	-	F, 0	A, 0	D, 1
F	C, 0	-	B, 0	C, 1

Table Q6 (a) M_1 **(10 Marks)**

b. Prove the following theorem :
   i) The equivalence partition is unique
   ii) If two states, S_i and S_j of machine M are distinguishable, then they are distinguishable by a sequence of length n – 1 or less, where n is the number of states in M.

(06 Marks)

Module-4

7 a. Given the machine table in Table Q7(a) M_2 and two assignments α and β, derive in each case the logical equations for the state variables and the output function.

	NS		Z	
	X = 0	X = 1	X = 0	X = 1
A	D	C	0	0
B	F	C	0	1
C	E	B	0	0
D	B	E	1	0
E	A	D	1	1
F	C	D	1	0

Table Q7(a), M_2

	y_1	y_2	y_3
A →	0	0	0
B →	0	0	1
C →	0	1	0
D →	0	1	1
E →	1	0	0
F →	1	0	1

Assignment α

	y_1	y_2	y_3
A →	1	1	0
B →	1	0	1
C →	1	0	0
D →	0	0	0
E →	0	0	1
F →	0	1	0

Assignment β

(10 Marks)

b. Explain the lattice of closed partitions. **(06 Marks)**

OR

8 a. Construct the π – lattice for the machine M_3 shown in Table Q8(a)

PS	NS	
	X = 0	X = 1
A	E	B
B	E	A
C	D	A
D	C	F
E	F	C
F	E	C

Table Q8(a), M_3 **(10 Marks)**

b. Explain the following:
   i) Covers
   ii) The implication graph. **(06 Marks)**

Module-5

9 a. Draw the homing tree and synchronizing tree of machine M_4 shown in Table Q9 (a) and explain it.

PS	NS, Z	
	X = 0	X = 1
A	B, 0	D, 0
B	A, 0	B, 0
C	D, 1	A, 0
D	D, 1	C, 0

Table Q9(a), M_4 **(10 Marks)**

b. Write a note on :
   i) Distinguishing tree
   ii) Adaptive distinguishing experiments **(06 Marks)**

OR

10 a. What is diagnosable sequence machine? Construct testing table and graph for machine shown in Table Q10 (a).

PS	NS, Z	
	X = 0	X = 1
A	B, 0	D, 0
B	A, 0	B, 0
C	D, 1	A, 0
D	D, 1	C, 0

Table Q10(a) **(10 Marks)**

b. List the general procedure in second algorithm for the design of fault detection experiments. **(06 Marks)**

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CBCS Scheme

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15EC553

Fifth Semester B.E. Degree Examination, Dec.2017/Jan.2018
Operating Systems

Time: 3 hrs. Max. Marks: 80

Note: Answer any FIVE full questions, choosing ONE full question from each module.

Module-1

1 a. Define operating system. What are the goals of an operating system? Explain. **(08 Marks)**

b. List and explain the different computational structures of operating system. **(08 Marks)**

OR

2 a. What are the different classes of operating system? Explain them with their primary concern. **(10 Marks)**

b. Explain the terms : i) Efficiency ii) System performance iii) user service. **(06 Marks)**

Module-2

3 a. With the help of a neat sketch, explain the view of processor. **(08 Marks)**

b. Define process state. Write a neat sketch, explain the fundamental state transitions of processes. **(08 Marks)**

OR

4 a. For the given set processes, perform FCFS and SRN scheduling. Compare their performance in terms of mean turnaround time and mean weighted turnaround time. **(10 Marks)**

Processes	P_1	P_2	P_3	P_4	P_5
Admission time	0	2	3	5	9
Service time	3	3	2	5	3

b. Write a neat sketch, explain long – medium and short term schedulers. **(06 Marks)**

Module-3

5 a. Compare contiguous and non–contiguous memory allocation techniques. **(08 Marks)**

b. Define :
i) Internal and external fragmentation
ii) Paging and segmentation
iii) Logical address and physical address
iv) Page and page frame. **(08 Marks)**

OR

6 a. Write a neat sketch, explain the concepts involved in demand loading of a page. **(08 Marks)**

b. Explain FIFO and LRU page replacement policies. Show the operation of FIFO and LRU policies for the page reference string : 0, 1, 0, 2, 0, 1, 2 and time reference sting : t_1, t_2, t_3, t_4, t_5, t_6, t_7 and find out number of page faults. Given : number of page frames = 2. **(08 Marks)**

Module-4

7 a. Explain the file system and the IOCS with necessary sketches. **(08 Marks)**

b. Explain the fundamental file organizations. **(08 Marks)**

OR

8 a. What is a directory? Explain directory fields and its operation with a simple directory structure. **(08 Marks)**

b. Explain the file system actions when a file is opened. **(08 Marks)**

Module-5

9 a. Define message passing. Illustrate the implementation of message passing. **(08 Marks)**

b. Define mailbox. Explain message passing using a mailbox with necessary sketches. Also mention the advantages of using mail boxes. **(08 Marks)**

OR

10 a. Define Deadlock. Explain the deadlock handling approaches. **(08 Marks)**

b. With necessary sketches, explain the different deadlock prevention approaches. **(08 Marks)**

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CBCS Scheme

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15EC561

Fifth Semester B.E. Degree Examination, Dec.2017/Jan.2018
Automotive Electronics

Time: 3 hrs. Max. Marks: 80

Note: Answer any FIVE full questions, choosing one full question from each module.

Module-1

1 a. Explain the different strokes for a four stroke SI engine, with suitable diagram. **(08 Marks)**

b. What are the drive train? With schematic explain the planetary gear system. **(08 Marks)**

OR

2 a. Explain the effect of Air/Fuel Ratio on performance. **(08 Marks)**

b. Briefly explain with neat diagram spark plug. **(08 Marks)**

Module-2

3 a. What is hall effect? Explain a position sensor using principle of hall effect. Compare it with magnetic reluctance position sensor. **(08 Marks)**

b. With neat diagram explain Ignition system. **(08 Marks)**

OR

4 a. With relevant diagrams optical crankshaft position sensor. **(08 Marks)**

b. Explain the working of fuel injector and pulse mode fuel control signals with relevant diagram and waveforms. **(08 Marks)**

Module-3

5 a. What are seven modes of fuel control? Explain with neat diagram digital engine control system. **(08 Marks)**

b. With a neat block diagram, explain EGR control. **(08 Marks)**

OR

6 a. What is the use of secondary Air? With the help of a diagram explain how the secondary air is controlled. **(08 Marks)**

b. What are the various modules of control unit? Write a block diagram depicting those modules. **(08 Marks)**

Module-4

7 a. Explain the cruise control system with relevant diagram. **(08 Marks)**

b. Explain Antilock braking system with relevant diagrams. **(08 Marks)**

OR

8 a. With relevant diagram, write a note on digital speed sensor. **(08 Marks)**

b. Write a note on system diagnosis. **(08 Marks)**

Module-5

9 a. With neat block diagram, explain the timing light used to measure and set ignition timing. **(08 Marks)**

b. Write a note on deadlock reckoning navigation. **(08 Marks)**

OR

10 a. Explain Accelerometer based Air Bag system with relevant diagrams. **(08 Marks)**

b. Explain Collision Avoidance Radar warning system with relevant diagrams. **(08 Marks)**

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15EC562

Fifth Semester B.E. Degree Examination, Dec.2017/Jan.2018
Object Oriented Programming Using C++

Time: 3 hrs. Max. Marks: 80

Note: Answer any FIVE full questions, choosing one full question from each module.

Module-1

1 a. Define and hence give the syntax for declaring a variable. State the rules to be followed for declaring variables in C++. **(04 Marks)**

b. What is Dynamic memory management? Explain 'new' and 'delete' operator with an example. **(06 Marks)**

c. What are Enumerations in C++? Explain with an example. **(06 Marks)**

OR

2 a. What are data types in C++? List all the built in and derived data types with examples. **(06 Marks)**

b. With syntax and example give the control structures for switch and while statement. **(07 Marks)**

c. Give the examples for Relational, logical and Bitwise expressions available in C++. **(03 Marks)**

Module-2

3 a. What are inline functions? Why are they used? Explain with an example. List the situations where inline function cannot be used? **(08 Marks)**

b. Define a class and object. Write a C++ program to define a class called student with roll number, name and percentage as its data members and getdata ( ), printdata ( ) as member functions. **(08 Marks)**

OR

4 a. Write a program to create a class called employee consisting of name, designation, id and salary as class data variables. Using this class, print 5 employee information by reading the information of employee. Write the main program to create objects and call a member functions from class. **(08 Marks)**

b. What is a friend function? Give its characteristics. Write a program to find mean value of 2 numbers using friend function. **(08 Marks)**

Module-3

5 a. Define a constructor and destructors with examples. Illustrate the working of both with sample programs. **(08 Marks)**

b. Write a C++ program containing two data members height and base, use a constructor to set height and base with area ( ) and display ( ) as member function to calculate area of a triangle. **(08 Marks)**

OR

6 a. Mention the types of operators that cannot be overloaded. **(02 Marks)**

b. What is a copy constructor? Illustrate the working of copy constructor with a program. **(06 Marks)**

c. Discuss the principle of operator overloading. Write a C++ program to add two complex numbers by overloading operator. **(08 Marks)**

Module-4

7 a. How is polymorphism achieved in OOPS with virtual functions? Explain with an example. **(08 Marks)**

b. What are pure virtual functions? **(02 Marks)**

c. Explain the role of 'this' pointer with an example. **(06 Marks)**

OR

8 a. Give the syntax and example for defining derived class. Explain the access specifiers public, private and protected with examples. **(08 Marks)**

b. Explain the following with reference to OOPS

i) Single inheritance

ii) Multiple inheritances. **(08 Marks)**

Module-5

9 a. What are streams in C++? List and explain all the stream classes used for file operations. **(08 Marks)**

b. Explain the role with examples for unformatted I/O operation functions.

i) Put ( )

ii) get ( )

iii) getline ( )

iv) write ( ) **(08 Marks)**

OR

10 a. What are file input and output streams? Write a program for writing to and reading the data from a file using stream classes. **(08 Marks)**

b. With an example :

i) Explain the syntax for opening and closing of file operations.

ii) Explain End of file (EOF) operator **(08 Marks)**

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10EC52

Fifth Semester B.E. Degree Examination, Dec.2017/Jan.2018
Digital Signal Processing

Time: 3 hrs. Max. Marks:100

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

PART – A

1 a. Describe the process of frequency domain sampling and reconstruction of discrete time signals. **(10 Marks)**

b. Derive the relationship of DFT with z-transform. **(06 Marks)**

c. Compute the N-point DFT of the sequence $x(n) = 1,\ 0 \le n \le N-1$. **(04 Marks)**

2 a. Show that the multiplication of two DFTs leads to circular convolution of the corresponding sequences in time domain. **(07 Marks)**

b. Let x(n) be a finite length sequence with x(k) = (1, j4, 0, – j4). Find the DFT's of,

(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) $x_3(n) = x((n-1))_4$. **(07 Marks)**

c. Let $x(n) = (1, 2, -1, -2, 3, 4, -3, 4)$ with a 8-point DFT x(k). Evaluate (i) $\sum_{K=0}^{7} X(k)$

(ii) $\sum_{K=0}^{7} |X(k)|^2$ without explicitly computing DFT. **(06 Marks)**

3 a. Explain the filtering of long data sequence using overlap-add method. **(06 Marks)**

b. For sequences $x_1(n) = (2, -1, 2, 1)$, $x_2(n) = (1, 1, -1, -1)$:

(i) Compute circular convolution.

(ii) Compute linear convolution using circular convolution. Compare the result. **(07 Marks)**

c. Compute the output of a filter with an impulse response $h(n) = (3, 2, 1)$ for input $x(n) = (2, 1, -1, -2, -3, 5, 6, -1, 2, 0)$ using overlap save method. Use 8-point circular convolution. **(07 Marks)**

4 a. Find the number of complex multiplications and additions required to compute 128 point DFT using (i) Direct method (ii) FFT algorithm (radix – 2). What is the speed improvement factor? **(05 Marks)**

b. Develop DIF-FFT algorithm and obtain the signal flow diagram for N = 8. **(07 Marks)**

c. Using DIT-FFT algorithm, compute the DFT of a sequence $x(n) = (1, 1, 1, 1, 0, 0, 0, 0)$. **(08 Marks)**

PART – B

5 a. Explain the Butterworth filter characteristics. Obtain the second order Butterworth polynomial. **(06 Marks)**

b. Determine the order and cutoff frequency of Butterworth analog highpass filter with Pass band attenuation, frequency : 2 dB, 200 rad/sec.
and Stop band attenuation, frequency : 20 dB, 100 rad/sec. **(06 Marks)**

c. Let $H(s) = \frac{1}{(s+1)(s^2+s+1)}$ represent a LPF with passband of 1 rad/sec. Find H(s) for
   (i) LPF with passband 2 rad/sec.
   (ii) HPF with cutoff frequency 2 rad/sec.
   (iii) BPF with passband 10 rad/sec and center frequency of 100 rad/sec.
   (iv) BSF with stopband of 2 rad/sec and center frequency of 10 rad/sec. **(08 Marks)**

6 a. Realize the system function $H(z) = \frac{1+2z^{-1}}{(1+3z^{-1})(1+2z^{-1}+z^{-2})}$ in
   (i) Direct form I
   (ii) Direct form II
   (iii) Cascade form.
   (iv) Parallel form. **(12 Marks)**

b. Consider three stage FIR lattice structure having coefficients $K_1 = 0.2$, $K_2 = 0.4$ and $K_3 = 0.6$. Draw the lattice structure. Find the system function H(z) and realize it in direct form. **(08 Marks)**

7 a. Compare FIR and IIR filters. **(04 Marks)**

b. The desired frequency response of a LPF,

$$H_d(\omega) = \begin{cases} e^{-j2\omega}, & |\omega| < \frac{\pi}{4} \\ 0, & \text{Otherwise} \end{cases}$$

Find the impulse response h(n) using Hamming window. Determine the frequency response of FIR filter. **(08 Marks)**

c. A low pass filter has the desired frequency response,

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

Determine the filter coefficients based on frequency sampling technique. **(08 Marks)**

8 a. Obtain the mapping rule for bilinear transformation. What is the effect on digital frequency in this transformation? **(08 Marks)**

b. Design a digital Butterworth low pass filter to meet the following specifications:
Pass band attenuation, frequency : 2 dB at 0.2 π rad
Stop band attenuation, frequency : 13 dB at 0.6 π rad
Use backward difference method with T = 1 sec. **(08 Marks)**

c. Determine the order of a digital Chebyshev 1 filter that satisfies the following constraints:

$$0.8 \le |H(\omega)| \le 1, \quad 0 \le \omega \le 0.2\pi$$
$$|H(\omega)| \le 0.2, \quad 0.6\pi \le \omega \le \pi$$

(04 Marks)

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10EC53

Fifth Semester B.E. Degree Examination, Dec.2017/Jan.2018
Analog Communication

Time: 3 hrs. Max. Marks:100

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

PART – A

1 a. Define Random variables and differentiate between discrete and continuous random variables. List the properties of PDF. **(07 Marks)**

b. Discuss the properties of Gaussian process. **(07 Marks)**

c. State and prove Central Limit theorem. **(06 Marks)**

2 a. Describe the generation of AM wave using square law modulator with mathematical analysis. **(08 Marks)**

b. An AM wave has the form :
$S(t) = 20[1 + 1.5 \cos 2000 \pi t - 1.5 \cos 4000 \pi t] \times \cos 40000 \pi t$.
i) Find the carrier power and side band power ii) Find the S(f) and sketch its spectrum
iii) Find the modulation index. **(07 Marks)**

c. Explain the single tone modulation of DSBSC wave with frequency spectrum. **(05 Marks)**

3 a. Explain the operation of quadrature carrier multiplexing scheme with transmitter and receiver diagrams. **(07 Marks)**

b. Define Hilbert transform. Explain the properties of Hilbert transform. **(07 Marks)**

c. Consider the message signal m(t) containing the frequency components 100Hz, 200Hz and 400Hz. This message signal is applied to a SSB modulator together with a carrier at 100KHz with only USB retained. The coherent detector employed at the receiver uses a local oscillator that gives a sine wave of frequency 100.02KHz. Determine the frequency components of the detector O/P. **(06 Marks)**

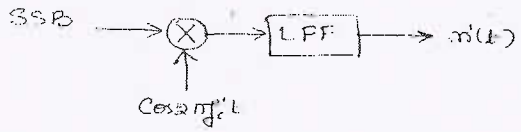

Fig.Q3(c)

4 a. Show that a VSB modulated S(t) containing a vestige of the lower side band is defined by
$S(t) = \frac{Ac}{2} m(t) \cos 2\pi fct - \frac{Ac}{2} M_Q(t) \sin 2\pi fct$ with relevant spectrum. **(08 Marks)**

b. Explain how downward frequency translation is achieved with the help of a block diagram and waveforms. **(08 Marks)**

c. Compare amplitude modulation techniques. **(04 Marks)**

PART – B

5 a. Show that the spectrum of FM contains infinite number of sidebands. **(08 Marks)**

b. A 93.2MHz carrier is frequency modulated by a 5KHz sine wave. The resultant FM signal has a frequency deviation 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. **(07 Marks)**

c. Give the relationship between frequency modulation and phase modulation, with scheme for generating an FM wave by using a phase modulator. **(05 Marks)**

6 a. Explain FM detection using PLL. **(07 Marks)**

b. Draw the block diagram of balance frequency discriminator and explain it for demodulation of FM signal. **(08 Marks)**

c. Explain non – linearity and its effect in FM system. **(05 Marks)**

7 a. Explain the following :
i) Thermal Noise ii) Shot Noise
iii) Noise figure iv) Equivalent Noise temperature. **(12 Marks)**

b. In a TV receiver a long lossy cable is used to connect the antenna to the receiver. To overcome the effect of lossy cable, a pre – amplifier is mounted on the antenna as shown as fig. Q7(b). Find the overall noise figure with and without pre amplifier. **(08 Marks)**

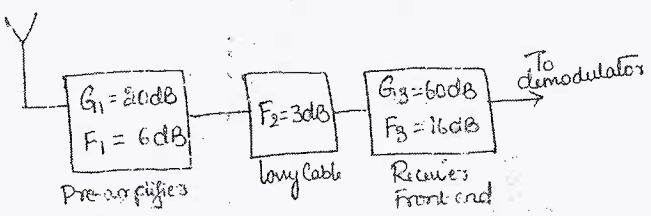

Fig.Q7(b)

8 a. Write short notes on :
i) Pre - emphasis and de-emphasis in FM ii) FM Stereo Multiplexing. **(10 Marks)**

b. Considering the model of DSBSC receiver using Coherent detection, explain the noise in DSBSC receiver and derive the Expression for figure of Merit. **(10 Marks)**

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10EC54

Fifth Semester B.E. Degree Examination, Dec.2017/Jan.2018
Microwaves and Radar

Time: 3 hrs. Max. Marks:100

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

PART – A

1 a. What are standing waves? Explain. **(05 Marks)**

b. Define and derive expressions for reflection coefficient, transmission coefficient and voltage standing wave ratio. **(10 Marks)**

c. An open wire transmission line has R = 5Ω/m L = 5.2×10^{-8}= H/m, G = 6.2×10^{-3} Ʊ/m and C = 2.13×10^{-10} F/m. Signal frequency is 4GHz. Find characteristic impendence and propagation constant. **(05 Marks)**

2 a. What is stub matching? Derive the expression for the length and location of the short circuited stub used in single stub matching. **(12 Marks)**

b. A single stub tuner is to match a lossless line of 400Ω to a load 800 – j300Ω. The frequency of operation is 3GHz.
i) Find the distance in meters from the load to the tuning stub
ii) Determine the length in meters of the short circuited stub
Note: Use Smith chart. Give the procedure in steps. **(08 Marks)**

3 a. Starting from wave equation, derive the field component expressions for TM_{mn} mode of propagation in a rectangular waveguide. **(10 Marks)**

b. Explain a two-hole directional coupler listing out its characteristics. **(06 Marks)**

c. A matched isolator has insertion loss of 1db and isolation of 30db. Find the scattering coefficients. **(04 Marks)**

4 a. Briefly explain the different modes of operation in a Gunn diode. **(08 Marks)**

b. List out the properties of S – parameters. **(06 Marks)**

c. Prove that it is impossible to construct a perfectly matched lossless reciprocal 3-part junction. **(06 Marks)**

PART – B

5 a. Explain with a neat sketch precision type variable attenuator. **(08 Marks)**

b. What are applications of Magic Tee? Briefly explain any one of them. **(06 Marks)**

c. In a H-plane Tee junction, compute power delivered to the loads 40Ω and 60 Ω connected to collinear arms 1 and 2 when 10mW power is delivered to arm 3. Assume $Z_0 = 50\Omega$. **(06 Marks)**

6 a. With relevant equation explain various losses in a microstripline. (12 Marks)

b. A lossless parallel strip line has its conducting strip of with W. The dielectric material of the strip line has a thickness of 4mm and its permittivity is 4. Compute :

i) Value of W so that $z_o = 75\Omega$

ii) Strip-line capacitance

iii) Strip line inductance

iv) Phase velocity of the wave propagating through the line. (08 Marks)

7 a. Derive the simple Radar Range equation, Discuss the factors influencing the Radar Range. (10 Marks)

b. Give some important application of Radar. (04 Marks)

Compute the range of a radar system operating at a wavelength of 3cm, peak pulse power of 400kW, effective antenna aperture of $5m^2$, radar cross sectional area of $20m^2$ and minimum detectable signal of 10^{-13}W. What will be the transmitter power needed to double the range. (06 Marks)

8 a. With a block diagram, explain the working of a MTI radar. (08 Marks)

b. Write short note on :

i) Blind speed

ii) Delay line cancellers. (08 Marks)

c. A MTI Radar has a PRF of 1000Hz at 4GHz. Compute lowest, second lowest and third lowest blind speeds expressed in Kmph. (04 Marks)

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10EC55

Fifth Semester B.E. Degree Examination, Dec.2017/Jan.2018
Information Theory and Coding

Time: 3 hrs. Max. Marks:100

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

PART – A

1 a. A source emits one of the four probable messages m_1, m_2, m_3 and m_4 with probabilities 3/11, 2/11, 2/11 and 4/11 respectively. Find the entropy of the source and show that for the second order extension of the source $H(S^2) = 2\ H(S)$ by listing the symbols of second extended source along with their probabilities. **(10 Marks)**

b. A certain data source has 8 symbols that are produced in blocks of four at a rate of 500 blocks/sec. The first symbol in each block is always the same for synchronization. The remaining three symbols are filled by any of the 8 symbols with equal probability. Find entropy rate of this source. **(06 Marks)**

c. Explain the block diagram of an information system. **(04 Marks)**

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

b. Show that $H(X, Y) = H(Y) + H(X/Y)$. **(04 Marks)**

c. The state diagram of the mark off source is as shown in the Fig.Q2(c).
   i) Find the stationary distribution
   ii) Find the entropy of each state and hence the entropy of the source
   iii) Find the entropy of the adjoint source and verify that $H(S) < H(\bar{S})$. **(12 Marks)**

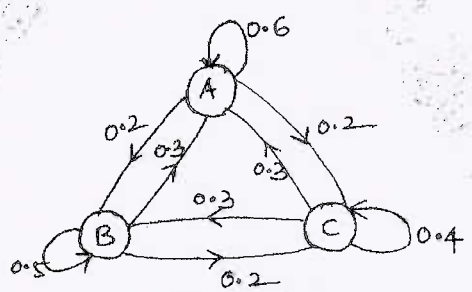

Fig.Q2(c)

3 a. A discrete memoryless source has an alphabet of seven symbols with probabilities for its output as $S = \{S_1, S_2, S_3, S_4, S_5, S_6, S_7\}$; $P = \{0.25, 0.25, 0.125, 0.125, 0.125, 0.0625, 0.0625\}$; $x = \{0, 1\}$, compute the Huffman code for this source, moving the composite symbol as high as possible. Explain why the computed source code has an efficiency of 100%. **(12 Marks)**

b. Prove that the mutual information of the channel is symmetric. **(04 Marks)**

c. Define priori entropy, posteriori entropy, equivocation and mutual information. **(04 Marks)**

4 a. Two noisy channels are cascaded whose channel matrices are given by :

$$P(Y/X) = \begin{bmatrix} 1/3 & 1/3 & 1/3 \\ 1/2 & 1/3 & 1/6 \end{bmatrix} \quad P(Z/Y) = \begin{bmatrix} 0 & 3/5 & 2/5 \\ 1/3 & 2/3 & 0 \end{bmatrix}$$

With $P(x_1) = P(x_2) = 1/2$. Find the overall mutual information I(X,Z) and show that $I(X, Y) \geq I(X, Z)$. **(12 Marks)**

b. Alphanumeric data are entered into a computer from a remote terminal through a voice - grade telephone channel. The channel has a bandwidth of 3.2KHz and output signal to noise ratio of 20dB. The terminal has a total of 256 symbols. Assume that the symbols are equiprobable and the successive transmissions are statistically independent.

i) Calculate channel capacity
ii) Find the average information content per character
iii) Calculate the maximum symbol rate for which error free transmission over the channel is possible. **(08 Marks)**

PART – B

5 a. Design a systematic (4, 2) linear block code :

i) Find the generator matrix [G] and parity check matrix [H]
ii) Find all possible code vectors
iii) Write the standard array
iv) What are the error detecting and correcting capabilities of the code?
v) Draw the encoding circuit
vi) Draw the syndrome calculating circuit. **(14 Marks)**

b. Draw the general encoding circuit for (n, k) linear block code and explain its operation. **(06 Marks)**

6 a. Consider (15, 5) cyclic code generated by polynomial $g(x) = 1 + x + x^2 + x^4 + x^5 + x^8 + x^{10}$.

i) Draw the block diagram of an encoder and syndrome calculator for this code
ii) Find the code polynomial for the message polynomial $D(x) = 1 + x^2 + x^4$ in systematic form.
iii) Is $V(x) = 1 + x^4 + x^6 + x^8 + x^{14}$ a code polynomial? **(12 Marks)**

b. Draw the general block diagram of syndrome calculation circuit for cyclic codes and explain its operation. **(08 Marks)**

7 a. Write short notes on : i) RS codes ii) Golay codes iii) Shortened cyclic codes iv) Burst error correcting codes. **(15 Marks)**

b. Define cyclic code. Explain how cyclic codes are generated from the generating polynomials. **(05 Marks)**

8 a. Consider the convolution encoder is as shown in the Fig. Q8(a).

i) Draw the state diagram
ii) Draw the code tree
iii) Find the encoder output produced by the message sequence 10111
iv) Verify the output using time – domain approach (matrix method). **(14 Marks)**

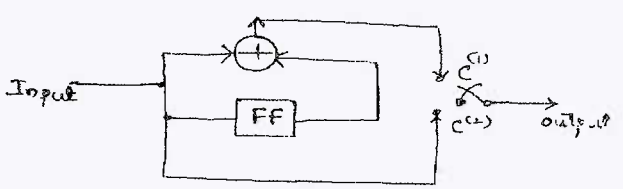

Fig.Q8(a)

b. Explain encoding of convolution codes using time domain approach with an example. **(06 Marks)**

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10EC56

Fifth Semester B.E. Degree Examination, Dec.2017/Jan.2018
Fundamentals of CMOS VLSI

Time: 3 hrs. Max. Marks:100

Note: 1. *Answer any FIVE full questions, selecting at least TWO questions from each part.*
2. *Draw Neat diagram.*

PART – A

1 a. Describe with neat diagrams, the P-well fabrication process. **(08 Marks)**

b. Explain the DC transfer characteristics of CMOS inverter and mark all the regions of operation with necessary expressions for V_{out} in each region. **(08 Marks)**

c. Compare CMOS and Bipolar Technology. **(04 Marks)**

2 a. Explain Transmission gate and Tristate inverter operations with neat diagram. **(06 Marks)**

b. Give the λ-based design rules for different layers, p and n MOSFETS and contact cuts. **(08 Marks)**

c. Obtain the stick diagram and layout of two way selector with enable. **(06 Marks)**

3 a. What are the features of CMOS Domino logic? Explain with neat diagram. **(06 Marks)**

b. In the following circuit find V_1, V_2, V_3 and V_4. **(06 Marks)**

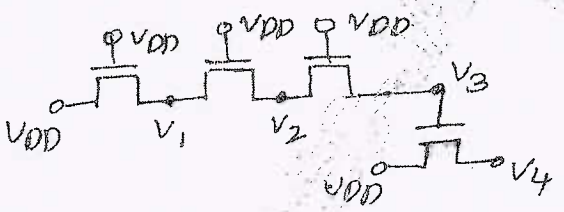

Fig Q3(b) 1

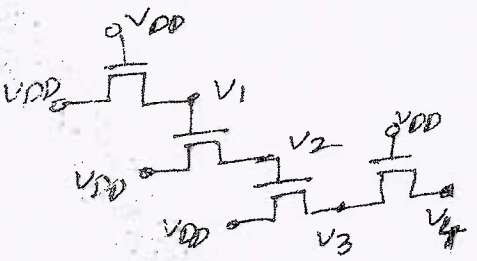

Fig Q3(b) 2

c. Explain following logic structure with their salient features with neat diagram
i) Pseudo nMOS logic
ii) C^2MOS logic **(08 Marks)**

4 a. Define sheet Resistance and standard unit of capacitance □Cg. **(06 Marks)**

b. Explain cascaded inverter to drive large capacitance loads? Obtain an equation to find the number of stages. **(08 Marks)**

c. Calculate the total capacitance in terms of □Cg for the following Fig.Q4(c) **(06 Marks)**

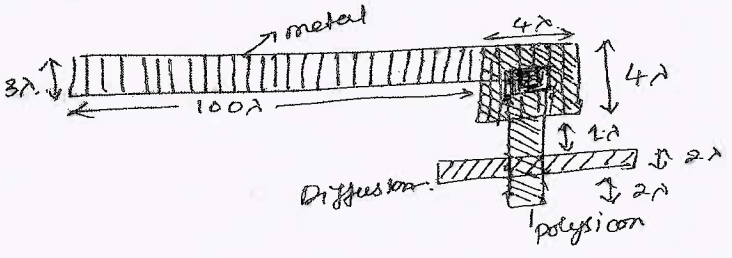

Fig Q4(c)

PART – B

5 a. What are the properties of nMOS and PMOS switches? How TG is useful. **(06 Marks)**

b. Explain the structure design of a parity generation with necessary diagrams and also write stick diagrams. **(08 Marks)**

c. Obtain the logic implementation of 4-way multiplexer (Selector) using nMOS switches with necessary diagrams. **(06 Marks)**

6 a. Explain nMOS and CMOS non-inverting dynamic storage cell and draw the 4-bit shift register using nMOS. **(07 Marks)**

b. How to implement arithmetic and logic operation with a standard adder? Explain with the help of logic expression. **(06 Marks)**

c. Explain 4×4 Barrel shifter with neat diagram. **(07 Marks)**

7 a. What are system timing consideration? **(05 Marks)**

b. Explain Read/write operation of one T dynamic memory cell (one transistor). **(05 Marks)**

c. Discuss Baugh Worley method used for Two's complement multiplication with neat diagrams. **(10 Marks)**

8 a. Write a note on Testability and Testing. **(06 Marks)**

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

c. Write short notes on :

i) Built in self Test (BIST)

ii) Scan design Technic. **(08 Marks)**

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