13/06/2025 TE EXTC SEM-V C-SCHEME DCC QP CODE: 10088078

Duration: 3 hours **Max Marks: 80**

N.B.: (1) Question No 1 is Compulsory.
(2) Attempt any three questions out of the remaining five.
(3) All questions carry equal marks.
(4) Assume suitable data, if required and state it clearly.

Q.1 Solve **any FOUR** questions. **[20]**

a What is a firewall? Explain its design principles. **[05]**

b Differentiate between arithmetic and dictionary coding techniques. **[05]**

c Explain the role of Discrete Cosine Transform (DCT) in image compression. **[05]**

d What are the major goals of data security? **[05]**

e State and prove Fermat's Little Theorem. **[05]**

Q. 2 **a** Explain DES algorithm in detail with its architecture. **[10]**

b Describe the H.264 video encoding and decoding process. **[10]**

Q. 3 **a** Compare JPEG and JPEG-2000 compression standards with respect to their architecture and performance **[10]**

b Explain RSA algorithm to encrypt the plain text message, M=9 for prime numbers p=11 and q=13, public key e =7. Verify that the decrypted text is the same as plain text. **[10]**

Q. 4 **a** Given a message "ABACAB" and the following probability distribution: **[10]**

- P(A) = 0.5
- P(B) = 0.3
- P(C) = 0.2

Perform **Arithmetic Coding** for the given message. Show all the intermediate steps, including the range calculation for each symbol.

b How Bob and Alice can do the key exchange using Diffie-Hellman Key Exchange algorithm? Explain with appropriate example. **[10]**

Q. 5 **a** Explain Intrusion Detection System and its types with examples. **[10]**

b What are the drawbacks of LZ77 dictionary technique and explain how it is overcome using LZ78 method with appropriate example and initial dictionary. **[10]**

Q. 6 **a** What is the difference between digital signature and message authentication code? Explain their roles in ensuring secure communication. **[10]**

b Prove the Chinese Remainder Theorem and illustrate it with a practical application in modular arithmetic. **[10]**

03/06/2025 TE EXTC SEM-V C-SCHEME DC QP CODE: 10080140

Time: 3 Hours **Marks: 80**

N.B.: (1) Question No 1 is Compulsory.
(2) Attempt any three questions out of the remaining five.
(3) Assume suitable data wherever necessary.
(4) Figures to the right indicate full marks.

1		Attempt any FOUR	
	a	What is modulation? What are the types of modulation?	[5]
	b	Explain different error control systems.	[5]
	c	Compare BASK, BPSK, BFSK, 4-ary FSK and 8-ary PSK in terms of bandwidth.	[5]
	d	Calculate 4-bits checksum for the data 110011111011	[5]
	e	Calculate CRC bits for the data 10000 using $g(x) = x^8 + x^2 + x + 1$	[5]
	f	Describe Integrate and dump receiver.	[5]
2	a	Explain Shannon-Hartley theorem and determine the channel capacity if the bandwidth is infinite.	[10]
	b	Write the algorithms for determining Huffman code and Shannon-Fano code and select a suitable example to show the code generation.	[10]
3	a	What is line code? What parameters need to be considered for selecting a line code for a specific application?	[10]
	b	Draw the shift register circuit for (7, 4) systematic cyclic code encoder with $g(x) = x^3 + x^2 + 1$ and generate parity bits for the data 1000 and 1010.	[10]
4	a	Explain error detection and correction procedure for systematic linear block code.	[10]
	b	Derive the PSD of the QPSK signal, draw the power spectrum and find the bandwidth.	[10]
5	a	Sketch the signal space diagram of MSK and determine the error probability.	[10]
	b	Explain 16-ary QASK modulator and demodulator with suitable equations.	[10]
6	a	Show that the performances of matched filter and correlator are identical.	[10]
	b	Explain Viterbi's decoding algorithm with a suitable example.	[10]

09/06/2025 TE EXTC SEM-V C-SCHEME DVLSI QP CODE: 10087593

Duration: 3hrs **[Max Marks: 80]**

N.B. : (1) Question No 1 is Compulsory.
(2) Attempt any three questions out of the remaining five.
(3) All questions carry equal marks.
(4) Assume suitable data, if required and state it clearly.

1 Attempt any FOUR [20]

a Define the term Clock skew and its various types.

b For a NMOS transistor if (W/L)=10 $\mu_n C_{OX}$=100μA/V^2 and if Overdrive voltage is 2V then calculate the Value of drain current I_D and Trans conductance gm.

c Draw and Explain the working of NAND based Flash memory.

d Realize 4:1 mux using TG logic.

e Draw the mask layout diagram for PMOS & NMOS transistor using lambda based design rules.

2 a Draw & Explain working of 6T SRAM with its read and write operation. [10]

b Draw and explain the process of fabricating NMOS transistor. [10]

3 a Realize Clocked S-R flip flop using Static CMOS logic and explain the working. [10]

b Draw and explain CMOS inverter with transfer characteristic. Derive the expression for its Threshold voltage. [10]

4 a Draw and explain 4 bit carry select adder along with its advantages and disadvantages. [10]

b Design a 'soda vending machine' using the RTL design process. [10]

5 a Realize the expression $Y = \overline{AB + CD}$ using the following logic style. [10]

1. CMOS logic
2. Pseudo NMOS
3. Dynamic Logic
4. Domino Logic

b Realize the 2 input NAND and NOR gate using CMOS logic. Find equivalent CMOS inverter for simultaneously switching of all input. Assume $(\frac{W}{L})p = 20$, $(\frac{W}{L})n = 15$ [10]

6 a With respect to suitable figure explain the various parasitic capacitors associated with the MOSFET. [10]

b Design 4 *4 bit NOR based memory array and its row decoder to store the following data in respective memory locations. [10]

Memory address	Data
1000	0011
0100	0101
0010	1111
0001	1010

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Duration 3 Hours **[Maximum Marks 80]**

NOTE:-1) Question 1 is compulsory. Solve any four out of five questions.
2) Solve any three from the remaining five questions
3) Assume suitable data if necessary.
4) Figures to the right indicate full marks

Q1	a.	Find the IDFT of Y(K)= {1,0,1,0}	5
	b.	Find the linear phase realization of FIR filter defined as $H(Z) = \frac{1}{4} + \frac{1}{2}Z^{-1} + \frac{3}{4}Z^{-2} + \frac{1}{2}Z^{-3} + \frac{1}{4}Z^{-4}$	5
	c	Compare the computational complexity of FFT algorithm and DFT for N=4	5
	d.	What is pre-warping in BLT?	5
	e	Explain the concept of group delay and how it can affect the output of a filter.	5
O2,	a	Compute the circular convolution of x(n)={2,1,2,1}and h(n)={1,2,3,4,}by using FFT-IFFT method.	10
	b	Design an FIR lowpass filter using rectangular window with passband gain of 0 dB, cutoff frequency of 200 Hz, sampling frequency of 1 kHz. Assume the length of the impulse response as 7.	10
O3	a	Find DFT of sequence $x(n) = n + 1$ for $0 \leq n \leq 7$ using DIF-FFT algorithm	10
	b	Design an analog Butterworth filter that has a -2dB passband attenuation at a frequency of 20rad/sec and atleast -10dB stopband attenuation at 30rad/sec	10
O4	a	Determine H(z) that results when the bilinear transformation is applied to analog filter defined by equation $H(s) = \frac{s^2 + 4.525}{s^2 + 0.692\,s + 0.504}$ Assume T=1sec.	10

b Find the effect of coefficient quantization on pole locations of the given second order IIR system, when it is realized in direct form I. Assume a word length of 4 bits through truncation including a sign bit. 10

$$H(z) = \frac{1}{1 - 0.9\,z^{-1} + 0.2\,z^{-2}}$$

O5 a. i) Given a second-order transfer function H(Z).Find Cascade form realization. 10

$$H(z) = \frac{1+\frac{3}{4}z^{-1}+\frac{1}{8}z^{-2}}{1-\frac{5}{8}z^{-1}+\frac{1}{16}z^{-2}}$$

ii) Given a second-order transfer function H(Z).Find parallel form realization.

$$H(z) = \frac{(1+z^{-1})(1+2z^{-1})}{(1+\frac{1}{2}z^{-1})(1-\frac{1}{4}z^{-1})(1+\frac{1}{8}z^{-1})}$$

b A FIR filter is given by, $y(n) = x(n) + \frac{2}{5}x(n-1) + \frac{3}{4}x(n-2) + \frac{1}{3}x(n-3)$ 10

Draw the Lattice structure.

Q6 a. Explain application of DSP in echo cancellation. 10

b. Explain the concept of overflow limit cycle oscillations 10

11/06/2025 TE EXTC SEM-V C-SCHEME RSA QP CODE: 10082843

Time: 3 Hours **Marks: 80**

N.B. : (1) Question No 1 is Compulsory.
(2) Attempt any three questions out of the remaining five.

1 **Attempt any FOUR** [20]

a Differentiate continuous and discrete random variable. [5]

b If 1% of the total screws made by a factory are defective, Find the probability that less than 3 screws are defective in a sample of 100 screws. [5]

c Differentiate between WSS and SSS. [5]

d What is the co-variance if [5]
i) Random variables are orthogonal
ii) Random variables are independent.

e Define auto correlation function. Discuss its properties. [5]

2 a State and prove properties of CDF. [10]

b A box contains three coins: two regular coins and one fake two-headed coin (P(H)=1P(H)=1), [10]
- You pick a coin at random and toss it. What is the probability that it lands heads up?
- You pick a coin at random and toss it, and get heads. What is the probability that it is the two-headed coin?

3 a Find the mean and variance of exponential distribution. [10]

$$f_x(x) = \begin{cases} \lambda e^{-\lambda x} & x > 0 \\ 0 & x \leq 0 \end{cases}$$

Where, λ is called the distribution rate.

b The joint probability density of two random variables is given by [10]

$$fx,y(X,Y) = \begin{cases} 15e^{-3x-5y} & x > 0, y > 0 \\ 0 \quad Otherwise & \end{cases}$$

Find the probability that
a) 1<X<2 and 0.2<Y<0.3
b) X<2 and Y>0.2
c) Find marginal probability distributions of X and Y

4 a State and prove Chebyshev inequality. [10]

b If {X(t)} = A cos λt + B sin λt; t >= 0 is a random process, where A and B are independent random variables each of which assumes the values -2 and 1 with probabilities 1/3 and 2/3 respectively, Prove that the X(t) is WSS . [10]

5 a x and y are two independent random variables with density function of the form [10]

$$f(t) = \begin{cases} te^{-t} & t > 0 \\ 0 \quad Otherwise & \end{cases}$$

Find pdf of z = x + y.

b Find characteristic function and hence find mean and variance of following binomial distribution $P(x) = \binom{n}{x} P^x q^{n-x}$ [10]

6 a Find regression line using the data [10]

X	1	3	5	7	8	10
Y	8	12	15	17	18	20

b Discuss the properties of linear time invariant system if input to the system is a WSS process. [10]

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