(3 Hours) **Total Marks-80**

N.B.: 1. Question No: 1 is compulsory.

2. Solve any three questions out of remaining questions.

3. Assume suitable data where necessary.

Q 1]	a)	Explain the instruction pipelining features of 8086.Give its advantages and its disadvantages.	**05M**
	b)	Write a program to display message "TE EXTC" on IBM PC. Use INT 21h function, AH=09 with string of message at DS: DX and terminated by "$".	**05M**
	c)	Differentiate between Assembler and Compiler.	**05M**
	d)	If 16k RAM (2 chips of 8k each) are interfaced with 8086.Assuming that physical address of RAM is 00000H,what will be starting and ending address of each chip?	**05M**
Q 2]	a)	Explain Maximum Mode of 8086 microprocessor. Draw the timing diagram for read operation in maximum mode.	**10M**
	b)	Write a program in assembly language for 8086 microprocessor to find power of a number. Number and power is stored at location 4000h & 4001h respectively. Store the result at location 4002h and 4003h.	**10M**
Q 3]	a)	Explain various operating modes of 8255 PPI.	**10M**
	b)	Draw and explain the block diagram of microprocessor based system in detail.	**10M**
Q 4]	a)	Draw and explain interfacing of Math Co-processor (8087) with 8086.	**10M**
	b)	Draw and explain 8086 based Data Acquisition System.	**10M**
Q 5]	a)	Explain the Interrupt structure of 8086 microprocessor.	**10M**
	b)	Write a program in assembly language for 8086 microprocessor to arrange a block of data 10- numbers in ascending order.	**10M**
Q 6]	a)	Design an 8086 based system with 32K ROM (2 chips of 16K). Draw the memory map of the system designed.	**10M**
	b)	Write a short note on String Instructions of 8086.	**10M**

Time: 3 Hours **Marks: 80**

NB. 1. Question No. **1** is **compulsory**.
2. Attempt **any three** out of remaining five questions.
2. Figures to right indicate full marks.
3. Assume data wherever required and state it clearly.

Q1 20

a) When are two events said to be independent? What is the joint probability of two independent events?
b) What is an optimum receiver and what is it optimized for?
c) Prove $H_{max} = \log_2 M$.
d) Estimate Nyquist rate and Nyquist interval for the signal $10\text{Cos}(2000\pi t)\ \text{Cos}(4000\ \pi t)$ based on low pass sampling theory.
e) For impulse responses $g^1=\{1,0,0\}$, $g^2=\{0,1,0\}$, $g^3=\{1,0,1\}$ design the state diagram.

Q2

a) A discrete memoryless source has an alphabet of six symbol with their probabilities as shown:

Symbol	M_1	M_2	M_3	M_4	M_5	M_6
Probability	1/2	1/4	1/8	1/16	1/32	1/32

i) Determine the Minimum Variance Huffman code-words and average code-word length and hence find Entropy of the system,
ii) Verify the average code-word length using Shannon Fano,
iii) Compare and comment on the results of both. 10

b) A convolution encoder has a constraint length of 3 and code rate of 1/3. The impulses for each are $g^1=100$ $g^2=101$ $g^3=111$. Draw
i) encoder
ii) state diagram
iii) code transfer function
10

Q3

a) What is PDF? How do we get PDF from probability distribution function? 10
b) What is matched filter? Derive the expression for its output SNR. 10

Q4

a) For a systematic linear block, the three parity check digits, C3, C2, C1 are given by:
$C3 = d1 \oplus d2 \oplus d3$
$C2 = d1 \oplus d2$
$C1 = d1 \oplus d3$
i) Find Generator matrix using which find out the code-words of 110 and 010 ,
ii) Determine the error correcting and detecting capability of system,
iii) Prepare suitable decoding table and find transmitted message for received code 101100 and 000110.
10

b) Sketch the encoder and syndrome calculator for the generator polynomial $g(x)=1+x^2+x^3$ and obtain the syndrome for the received code-word 1101011. 10

Q5

a) Discuss QPSK signalling. Derive the bit error probability due to PSK receiver. 10

b) Represent the given data sequence 110011010011 with help of neat waveforms in
   i) Manchester format
   ii) NRZ
   iii) AMI-RZ
   iv) RZ
   10

Q6

Explain with the required diagrams **(Any Three):** 20

i) Compare BPSK and QPSK
ii) Modified duo-binary encoder
iii) Gram- Schmidt orthogonalization procedure
iv) Define the following terms and give their significance

(i) Systematic and Non-systematic codes (ii) Code rate
(iii) Hamming distance (iv) Hamming weight

****

(3 Hours) **(Total Marks : 80)**

N.B.: 1. **Q. No. 1** is **compulsory**.
2. Attempt **any three** out of the remaining **five** questions.
3. Assume suitable **data**.

Q1. Attempt any **FOUR :** **(20)**

a) Write a short note on memristor.
b) A circular loop conductor having a radius of 0.15 m is placed in the x-y plane. This loop consists of a resistance of 20 Ω. If magnetic flux density is $\mathbf{B} = 0.5 \sin 10^3 t\ \mathbf{a_z}$ (Tesla) find the current flowing through this loop.
c) Derive Poisson's and Laplace's equation.
d) Derive continuity equation.
e) State and explain Gauss's law.
f) Define and explain the significance of vector magnetic potential.

Q2.a) Evaluate both sides of the divergence theorem for the field $\mathbf{D} = 2xy\ a_x + x^2\ \mathbf{a_y}$ (C/m^2) and a rectangular parallelepiped formed by the planes x=0 to 1, y= 0 to 2, z= 0 to 3. **(10)**

b) Derive expression to find magnetic field intensity due to infinite long straight conductor on z-axis by Biot- Savart law. **(10)**

Q3. a) Derive Maxwell's equation for time varying fields in point and integral form and explain its significance. **(10)**

b) Define reflection coefficient, transmission coefficient and standing wave ratio. For normal incidence, determine the amplitudes of reflected and transmitted electric and magnetic fields **E** and **H** at interface of two regions at z=0. Given: Incident $Ei = 1.5 \times 10^{-3}$ V/m. $\varepsilon_{r1} = 8.5$, $\mu_{r1} = 1$, $\sigma_1 = 0$. Second region is free space. **(10)**

Q4. a) State Poynting theorem. Derive mathematical expression for Poynting theorem and explain the meaning of each term. **(10)**

b) In free space, $V = 6xy^2z + 8$. Find electric field intensity **E** and volume charge density ρ_v at point P (1, 2,-5). **(10)**

Q5. a) A lossless transmission line with $Z_0 = 50\ \Omega$ is 30 m long and operates at 2 MHz. The line is terminated with a load $Z_L = 60 + j40\Omega$. If $\upsilon = 0.6$ c on the line, find reflection coefficient, standing wave ratio and input impedance.Use analytical method and Smith chart method. **(10)**

b) Derive boundary conditions for electrostatics and magnetostatics. **(10)**

Q6. Write short notes on any **FOUR :** **(20)**

a) Inkjet Printer.
b) Microstrip lines.
c) Graphene.
d) Wave propagation in free space.
e) Electric Dipole.
f) Skin effect.

(3 Hours) **Total Marks: 80**

Note the following instructions.

1. Question **No.1** is **compulsory**
2. Attempt **any three** questions from remaining **five** questions
3. Solve in **total four** questions
4. Assume suitable data wherever necessary, justify the same
5. **Figures** to the **right** indicate **full marks**.

1 a. Compare IIR and FIR digital filters [4]

b. State and prove time shifting property of DFT [4]

c. Compare general purpose and special purpose DSP processors [4]

d. Explain limit cycles in IIR digital filters [4]

e. A digital filter has the following impulse response identify the type of filter from pole zero plot. $h(n) = 0.8\,\partial(n) + 0.36(-0.8)^{n-1}u(n-1)$ [4]

2 a. Using BLT method of IIR filter design. Design a digital Butterworth HPF, monotonic in passband with 3dB frequency of 1000 Hz and down at 10 dB at 350 Hz. The sampling frequency is 5000 Hz [10]

b. Transform analog filter transfer function H(s) given below in to digital filter transfer function H(z) using Impulse Invariance Transformation method with T= 1 sec. $H(s) = \frac{0.5(s+4)}{(s+1)\,(s+2)}$ [5]

c. Explain the effect of coefficient quantization (truncation and rounding) on IIR filter. [5]

3 a. Design an FIR bandpass filter to meet following specification using frequency sampling method. [8]

i. Cutoff Frequencies = 1000 Hz and 3000 Hz,
ii. Sampling Frequency = 8000 Hz,
iii. Length of filter N=7

b. The unit sample response of a system is h(n) = {1, 2} use overlap-save method of linear filtering to determine output sequence for the repeating input sequences x(n) = {1, 2, 3, 4, 5, 6, 7, 8, 9, 10} [7]

c. One of the zero of an antisymmetric linear phase FIR filter lies at z = 0.5, find the location of the other zeros and hence find the transfer function and impulse response of the filter. [5]

4 a. For the sequences, x[n] ={ 1, 2, 4, 5}, p[n]={6, 3, 6, 9} & q(n) ={ 1, -2, 4,-5} [8]

i. Find X[k] using DFT.
ii. Find P[k] using X[k] only.
iii. Find Q[k] using X[k] only.

where x[n], p[n], q[n] and X[k], P[k], Q[k] are DFT pairs respectively

b. Design a digital FIR low pass filter using Hamming window for following specification, Cutoff frequency= 500 Hz, Sampling frequency = 2000 Hz, Order of filter = 10 [7]

c. Compare the truncation and rounding errors using Fixed point and Floating point representation [5]

5 a. If x(n) = {1, 1, 2, 2, 3, 3, 4, 4 }, Find X(K) using DIF-FFT algorithm. Compare computational complexity of above algorithm with DFT. [8]

b. Find DFT of the sample data sequence x(n) = { 1, 1, 2, 2, 3, 3} and compute the corresponding amplitude and phase spectrum [7]

c. Explain DTMF detection using Goertzel algorithm [5]

6. Write short notes on **any Two** [20]

a. Effect of finite word length in digital filters

b. Architecture of TMS320C67XX digital signal processor

c. Application of DSP for Radar signal processing

****

Duration :3hrs **Max.Marks:80**

(1) Question No. 1 is compulsory.

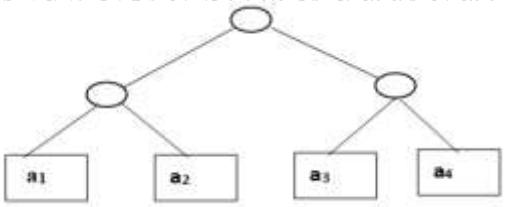
(2)Attempt any three questions out of remaining five.

(3)Figures to the right indicate full marks.

(4)Assume suitable data if required and mention the same in answer sheet

1.Solve **Any Four** **20**

a) For the Huffman Tree shown below show the root node, branch nodes and the siblings. Find the code for $\mathbf{a_1, a_2, a_3}$ and $\mathbf{a_4}$ from the tree. If average length of the code is 2bits/symbol and Entropy is 1.985bits/symbol. Calculate Redundancy and Efficiency of the code.



b) Using LZW algorithm encode the sequence **BABACABABA**

c) Encrypt the plain Text "MEET ME" using the key 421635.name the type of ciphering used here.How does it differ from Substitution ciphering

d) For a frame size of 640x480(WxH) at a colour depth of 24 bits and frame rate of 25 frames per second calculate all the important properties of Digital Video

e) Define Euler's theorem and Euler's Totient function and find $\phi(35)$

2. a) Encode **aabc** in the alphabet {a,b,c,d…….j} using adaptive Huffman coding algorithm, given the fixed length code for a=000, b=001, c=010 and d=100 10

b) State the difference between JPEG and JPEG 2000.State the applications advantages and limitations of JPEG 2000,Name the file name extension. 10

3. a) Explain DPCM and ADPCM used in audio compression 10

b) Illustrate with a neat sketch Frame sequence of MPEG compression and H.261.How do they differ in their quantization procedure and file name extension 10

4 a) What are the essential ingredients of symmetric cipher? explain 10

b) Explain the working of DES, How long is the DES key? 10

5. a) What characteristics are needed to secure Hash function? What is the role of compression function in Hash function ? 10

b) Explain RSA algorithm 10

6.Write short note on **(Any Four)** 20

a) SSL architecture

b)Fermat's theorem

c)Kerberos

d)Digital Signature

e)Cryptographic Attacks

****

(3 Hours) **[Total Marks : 80]**

Please check whether you have got the right question paper.

N.B.: **1) Question No.1 is Compulsory.**
2) Solve any three questions from reaming five questions.
3) Figures to the right indicate full marks.
4) Assume suitable data if required and mention the same in answer sheet.

1. Attempt **any four** **(20)**

i) Derive equation for gain of common gate amplifier
ii) Explain how MOSFET is used as controlled resistor
iii) Draw a mask layout of NMOS transistor
iv) Draw simple two transistor current mirror and derive expression for output current I_O and minimum output voltage required i.e V_{ON}.
v) Explain how inductors are fabricated in Integrated circuits.

2. a) What are different types of MOSFET scaling. Explain impact of scaling on MOSFET performance parameters such as I_{DS}, Area, Power and delay with the help of appropriate equations. **(10)**

b) Explain how cascode current mirror improves performance of simple current mirror. Also derive expression for output resistance and minimum output voltage required i,e V_{omin} for proper operation of cascode current mirror. **(10)**

3. a) Explain DC transfer characteristics of MOS differential Amplifier by deriving appropriate equations. **(10)**

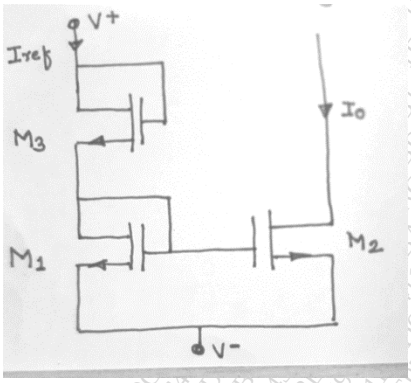
b) Explain with proper diagram class C power Amplifier. **(10)**

4. a) Explain NMOS fabrication process with suitable diagrams. **(10)**

b) Draw and explain the working of common source amplifier with NMOS diode connected load. Derive expression for voltage gain and output voltage swing. **(10)**

5. a) Design common source resistive load amplifier to meet following specification. **(10)**
Av ≥ 10, output swing = 3V, Pdmax ≤ 5mW.
Use $V_{DD} = 5V$, $\mu nCox = 150\mu A/V^2$, $\lambda = 0.01\ V^{-1}$, $V_{TN} = 1V$.

b) For the circuit shown below $V^+ = 10V$, $V^- = 0V$. Transistors parameters are V_{TN} = 2V, $\mu nCox = 40\mu A/V^2$ and $\lambda = 0$. Design the circuit such that $I_{REF} = 0.5$ mA, $I_O = 0.2$mA and M2 remains biased in saturation region for $V_{DS2} \geq 1V$. **(10)**



6. Write short notes on **any four** **(20)**

i) Bias Independent current source

ii) Class B power amplifier using MOSFET

iii) Fabrication of transforms

iv) Fabrication of variable capacitor

v) Short channel effects
