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

N.B. (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) Explain practical diode detector.

(b) Define sensitivity, image frequency rejection and fidelity for radio receiver.

(c) What is quantization? Explain types of quantization.

(d) Why IF is selected as 455 KHz in AM?

(e) List the applications of pulse communication.

2. (a) Explain concept of AM Wave with related equations and waveforms. **10**

(b) Draw the block diagram of phase cancellation SSB generator and explain how carrier and unwanted sidebands are suppressed? **10**

3. (a) Explain the operation of Foster seeley discriminator with the help of circuit diagram and phasor diagram. **10**

(b) Explain the principle and generation of indirect method of FM generation. **10**

4. (a) What are the drawbacks of delta modulation? Explain the method to overcome these drawbacks. **10**

(b) With the help of suitable waveforms explain generation and detection of PPM. **10**

5. (a) Explain Super heterodyne radio receiver in detail with block diagram. **10**

(b) Explain VSB Transmission in detail with its application. **10**

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

(a) Compare FM and PM

(b) FM noise triangle

(c) Noise figure and noise factor

(d) Frequency division Multiplexing (FDM)

(e) Pre emphasis and de-emphasis circuits

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4/2018

Paper / Subject Code: 32208 / Elective - I Data Compression and Encryption (DLOC) (EXTC)

LC T.E Sem.V (CBCGS) Dec 2018.

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

N.B. (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) Explain test for unique decodability with suitable example
(b) What are the main features of MPEG-1?
(c) Explain Chinese Reminder theorem (CRT) with example.
(d) What are the limitations of JPEG? How to overcome these limitations?
(e) What are the various models used for data compression?

2. (a) A Source K= [a, b, c, d] has probabilities [0.7,0.05,0.15,0.1] respectively. Generate tag for the sequence [a c d b a] using Arithmetic coding. **10**
(b) What is the significance of prime numbers in public key cryptography? Explain RSA algorithm with suitable example. **10**

3. (a) What do you mean by secure hash algorithm (SHA) explain in detail. What are the characteristics of secure hash algorithm? **10**
(b) Explain modification detection code (MDC) and message authentication code (MAC) w.r.t. message authentication. **10**

4. (a) Take an alphabet string and show encoding procedure for LZ78 and LZW. Compare LZ78 and LZW **10**
(b) Explain update procedure and encoding for the adaptive Huffman coding algorithm with suitable diagram / examples. **10**

5. (a) Explain Triple DES with Two Keys in detail. **10**
(b) Explain Ceaser Cipher and multiplicative cipher with suitable examples and diagrams. **10**

6. Write short note on(any four) **20**
(a) SSL Architecture
(b) Intrusion detection system
(c) PGP
(d) JPEG LS
(e) H.261

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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.

Que.1 Answer the following (Any **Four**) 20

a. Explain autocorrelation and covariance of random variable.
b. What are the properties of CDF?
c. What is Entropy of an information source? When is entropy maximum?
d. Give a comparison between the basic digital modulation techniques (ASK, FSK and PSK).
e. Explain role of hamming distance in error detection & correction?
f. Justify/Contradict: Syndrome depends on error pattern and received code word.

Q2

a. The nine symbols viz. A1, A2, A3, … A9 have corresponding probability of occurrences as 0.12, 0.2, 0.08, 0.25, 0.02, 0.04, 0.06, 0.13, 0.1. Determine the Huffman code, calculate the average code word length, entropy and coding efficiency. 10
b. Explain the working of Minimum Shift Keying, modulator and demodulator, with the help of block diagram and waveform. 10

Q3

a. Linear block code having following parity check equations – 10
c4=d1+d2+d3, c5=d1+d2, c6=d1+d3. Calculate G & H matrix, error detection & Correction capacity of the code, decode the received codeword-------101100
b. Derive the expression for the probability of error of the matched filter. 10

Q4

a. Discuss the problem of inter symbol interference (ISI). Explain the measures to be taken to reduce ISI. How to study ISI using eye pattern? 10

b. Generator vectors of convolution encoder are g1=101, g2=110, g3=011. Draw encoder, State table, State diagram & code trellis. Calculate the code word for the message vector 101011. 10

Q5

a. What are the random processes? Explain Central limit theorem. 10
b. Justify that distance of 16-QAM is greater than 16-Ary PSK & less than QPSK. 10

Q6 Write a short note on (**Any Three**) 20

a) Nyquist criterion for zero ISI
b) Systematic and non-systematic block codes
c) Power spectral density and bandwidth of 16-Ary PSK.
d) Coherent and non-coherent digital detection techniques.

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58761

(3 Hours) [Total Marks: 80]

N.B: (1) Questions No.1 is compulsory.
(2) Attempt any three questions out of remaining five questions.
(3) Assume suitable data if required.
(4) Figures to the right indicate full marks.

Q.1 Solve any four **20**

a) State the relationship between DTFS, DTFT and DFT.
b) Differentiate FIR and IIR filters.
c) Differentiate fixed point and floating point implementations.
d) A digital filter has the following transfer function. Identify type of filter and justify

$$H(z)=\frac{z}{z+0.5}$$

e) Explain how the speed is improved in calculating DFT by using FFT algorithm.

Q. 2 a) A high pass filter is to be designed with following desired frequency response. **10**

$$H_d(e^{jw}) = 0 \quad -\frac{\pi}{4} \le w \le \frac{\pi}{4}$$
$$= e^{-j2w} \quad \frac{\pi}{4} < |w| \le \pi$$

Determine the filter coefficients h(n) if the window function is defined as

$$w(n) = 1 \quad 0 \le n \le 4$$
$$= 0 \quad \text{otherwise}$$

Also determine the frequency response $H(e^{jw})$ of the designed filter.

b) Compute circular convolution of following sequences using DITFFT and IDITFFT **10**

$x_1(n)=\{1,2,1,2\}$ and $x_2(n)=\{1,2,1\}$

Q 3 a) Explain design steps for to design FIR filter using frequency sampling method. **10**

b) Explain the mapping from S-plane to Z-plane using impulse invariance technique. Also explain the limitations of this method. **10**

Q. 4 a) Design a Chebyshev-I filter with maximum passband attenuation of 2.5 dB at $\Omega p=20$ rad/sec and stopband attenuation of 30dB at $\Omega s=50$ rad/sec. **10**

b) Develop composite radix DIFFFT flow graph for $N=6=3\times2$. **10**

Q. 5 a) Design a digital Butterworth filter that satisfies following constraints using bilinear transformation method. Assume Ts=1s. **10**

$$0.707 \le |H(e^{jw})| \le 1 \quad 0 \le w \le \frac{\pi}{2}$$
$$|H(e^{jw})| \le 0.2 \quad \frac{3\pi}{4} \le w \le \pi$$

b) Explain the effects of finite word length in digital filters with examples. **10**

Q. 6. a) Explain application of DSP processor in ECG signal analysis. **10**

b) Draw neat architecture of TMS320C67XX DSP processor and explain each block. **10**

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1T01025 - T.E.(ELECTRONICS & TELE-COMMN)(Sem V) (Choice Based) Electromagnetic Engineering

Duration : 3 Hours Marks : 80

1] Question no. 1 is Compulsory
2] Attempt any three questions out of remaining questions
3] Assume suitable data if require

Q1 **Attempt any Four** **(20 Marks)**

a) Calculate charge density due to electric flux density $\bar{D} = 4r\sin\emptyset\,\widehat{a_r} + 2r\cos\emptyset\,\widehat{a_\emptyset} + 2z^2\widehat{a_z}\ C/m^2$

b) Obtain point format of Continuity equation

c) Express Biot Savart's law in vector format

d) For parallel plates capacitor with plate area $10cm^2$ and plates saperation 3mm has voltage of $100\sin 10^3 t\ V$ applied to its plates. Calculate displacement current density ($\varepsilon = 2\varepsilon_0$)

e) Define following terms:
- Uniform Plane waves
- TEM wave

f) Define the term Characteristic Impedance, Write expression for the same for Lossy and Lossless lines

g) Show that $\bar{E} = -\nabla V$

Q. 2 **(20 Marks)**

a) A sheet charge of $\rho_s = 2nC/m^2$ located at $x = 2$ in free space and line charge $\rho_l = 20nC/m$ is located at $x = 1$ & $z = 4$, find electric field at the origin and direction of electric field at (4,5,6)

b) For infinite long conductor of radius 'a' carrying current I, determine Magnetic field everywhere.

Q. 3 **(20 Marks)**

a) Explain in brief Maxwell's Equation for Time varying field in Integral and Point format, also give their significance

b) Magnetic field component of an EM wave propagating through a non-magnetic medium ($\mu = \mu_0$) is:

$$\bar{H} = 25\sin(2\times 10^8 t + 6x)\overline{a_y}\ mA/m$$

Determine:
- The direction of wave propagation
- The permittivity
- Electric Field

Q. 4 **(20 Marks)**

a) List boundary conditions for time varying field if given that:

$$\bar{D} = 50\overline{a_x} + 80\overline{a_y} - 30\overline{a_z}\ nC/m^2$$

In region $x \geq 0$ where $\varepsilon=2.1\varepsilon_0$. Find Electric charge density for region $x \leq 0$ where $\varepsilon=7.6\varepsilon_0$.

b) Obtain Poission's and Laplacian's Equation used to solve boundary problems for conducting plates described as V(z=0) = 0V and V(z=2mm) = 50V. Determine:
- V
- $\bar{E}$
- $\bar{D}$

Q. 5 **(20 Marks)**

a) Lossless 50Ω transmission line terminated by a load impedance $Z_L = 75 + 60j\ \Omega$, using Smith chart determine:

- Reflection Coefficient
- SWR
- Input Impedance at 0.2λ from load verifying the same using analytical solution

b) Obtain Integral form of Poynting Theorem and Explain significance of each term

Q. 6 Write short note on **(20 Marks)**

a) Electric Dipole
b) Electrostatic discharge
c) Magnetic Levitation
d) Wave propagation through lossy dielectrics

Q. P. Code: 50726

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

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

Q.1		Attempt any 4 questions:	
	(A)	Draw a neat circuit of half wave precision rectifier. Draw its input and output waveforms.	[05]
	(B)	Draw a neat circuit with all the component values of mono-stable multivibrator for timer application using IC 555 to obtain a pulse width of 1.1 ms. Take timing capacitor of value 1 µf.	[05]
	(C)	Draw a neat circuit of Current to Voltage converter. Give its output expression.	[05]
	(D)	Draw the functional block diagram of IC 723.	[05]
	(E)	Draw the internal structure of IC 7490 decade counter. Draw its timing diagram.	[05]
Q.2	(A)	Draw a neat circuit diagram of *RC* phase shift oscillator using op-amp. Derive its frequency of oscillation. What are the values of *R* and *C* if its frequency of oscillation is 1 kHz?	[10]
	(B)	Draw a mod-10 counter using IC 7493. Draw its timing diagram.	[10]
Q.3	(A)	With the help of a neat diagram and voltage transfer characteristics explain the working of inverting Schmitt trigger. Derive the expressions for its threshold levels.	[10]
	(B)	Design a voltage regulator using IC 723 to give V_o = 4 V to 32 V and output current of 2 A.	[10]
Q.4	(A)	Draw the circuit diagram of a square and triangular waveform generator using op-amps and explain its working with the help of waveforms. For variation in duty cycle what is the modification needed in the circuit.	[10]
	(B)	Design a second order Butterworth high pass filter for cut off frequency of 1 kHz and pass-band gain of AF=2.	[10]
Q.5	(A)	What is an instrumentation amplifier? Draw a neat circuit of an instrumentation amplifier using 3 op-amps. Derive its output voltage equation.	[10]
	(B)	With the help of a functional block diagram explain the working of voltage regulator LM317 to give an output voltage variable from 5 V to 10 V to handle maximum load current of 500 mA.	[10]
Q.6		Write short notes on: (Attempt any two)	
	(A)	Various parameters of op-amp.	[10]
	(B)	IC 74181 Arithmetic Logic Unit.	[10]
	(C)	Power amplifier LM380.	[10]

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Q.P. Code : 37932

[Time: Three Hours] [Marks:80]

Please check whether you have got the right question paper.

N.B: 1. Question.No.1 is compulsory.
2. Answer any three questions out of remaining five.
3. Assume suitable data wherever necessary.

Q.1		Attempt any four:	**20**
	a.	Explain function of T0 and T1 pins of 8051.	
	b.	Explain PSW of 8051 in detail.	
	c.	Explain Memory organization in 8051 microcontroller.	
	d.	Explain the concept of pipeline of ARM 7.	
	e.	Compare AJMP, SJMP and LJMP instruction of 8051.	
Q.2	a.	Explain interrupts in 8051 microcontroller.	**10**
	b.	Explain PORT 3 structure of 8051.	**10**
Q.3	a.	Explain interfacing of ADC 0808 with 8051.	**10**
	b.	List and explain the different core extension used with ARM processor.	**10**
Q.4	a.	Design 8051 based system with following specifications i) 8051 working at 10MHz. ii) 4 KB External Program memory using 2 KB chips iii) 8 KB External Data memory using 4 KB chips	**10**
	b.	Explain addressing modes of ARM with examples.	**10**
Q.5	a.	Explain stack operation in 8051 with examples.	**10**
	b.	Explain IR based wireless communication system.	**10**
Q.6			**20**
	a.	Explain current program status registers of ARM7	
	b.	Explain serial communication in 8051	
	c.	Explain "Digital camera as an embedded system"	
	d.	What are the challenges in optimizing embedded system design matrices?	

Paper / Subject Code: 32205 / Elective - I Microlectronics (DLOC) (EXTC)

T.E. Sem. V (CBCGS) Dec 2018

(3 Hours) Max. marks: 80

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

Q.1 Attempt any 4 questions [20]

(a) List the steps involved in fabrication process of MOSFET.
(b) Compare the output resistance of the cascade MOSFET current source to that of the two-transistor current source. Assume $I_{REF} = I_O = 100\ \mu A$ in both the circuits, $\lambda = 0.01\ V^{-1}$ for all transistors, and $g_m = 0.5$ mA/V.
(c) Draw a mask layout of NMOS transistor.
(d) Derive the equation for output resistance of common gate amplifier.
(e) Draw the equivalent model for transformer and explain.
(f) List the second order effects in MOSFET. Discuss any one of them.

Q.2 (a) Why is scaling required? Discuss the various types of scaling. [10]
(b) Consider the MOSFET current source in Fig. 2 (b) with $V^+ = 10$ V and $V^- = 0$, and the transistor parameters are: $V_{TN} = 1.8$ V, $\frac{1}{2}\mu_n C_{ox} = 20\ \mu A/V^2$, and $\lambda = 0.01\ V^{-1}$. The transistor width-to-length ratios are: $(W/L)_2=6$, $(W/L)_1=12$, $(W/L)_3=3$. Determine (i) I_{REF}, (ii) I_O at $V_{DS2} = 2$ V. [10]

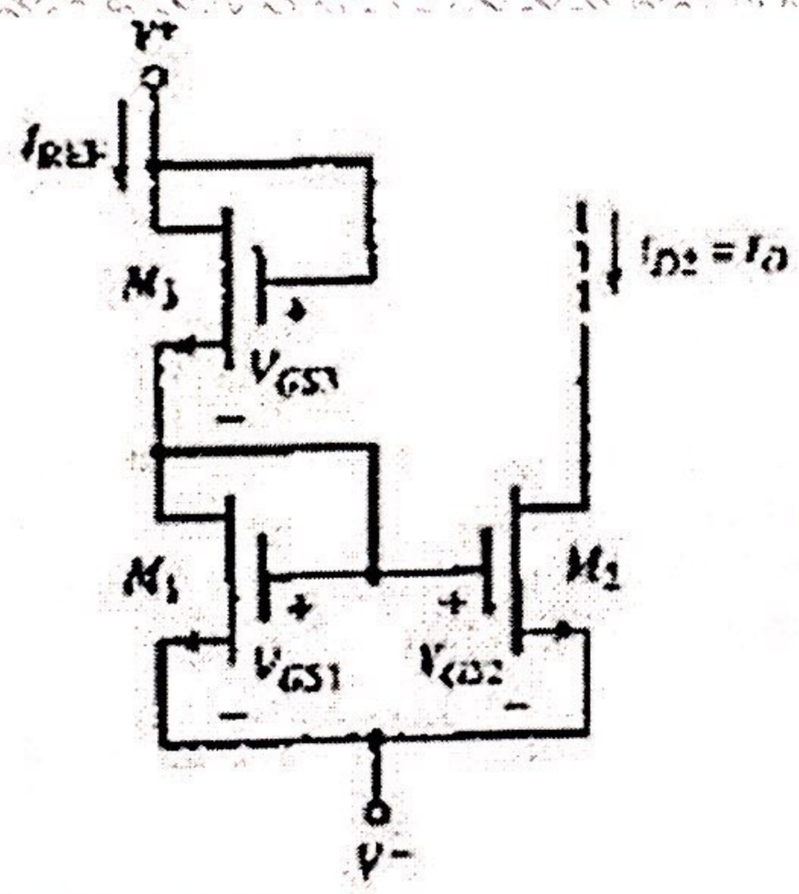

Fig. 2(b)

Q.3 (a) Consider the differential amplifier shown in Fig. 3(a). The transistor parameters are: $K_{n1}=K_{n2}=0.1\ mA/V^2$, $K_{n3}=K_{n4}=0.3\ mA/V^2$, and for all transitors, $\lambda=0$ and $V_{TN}= 1$ V. Determine the maximum range of common-mode input voltage. [10]

P.T.O

53615

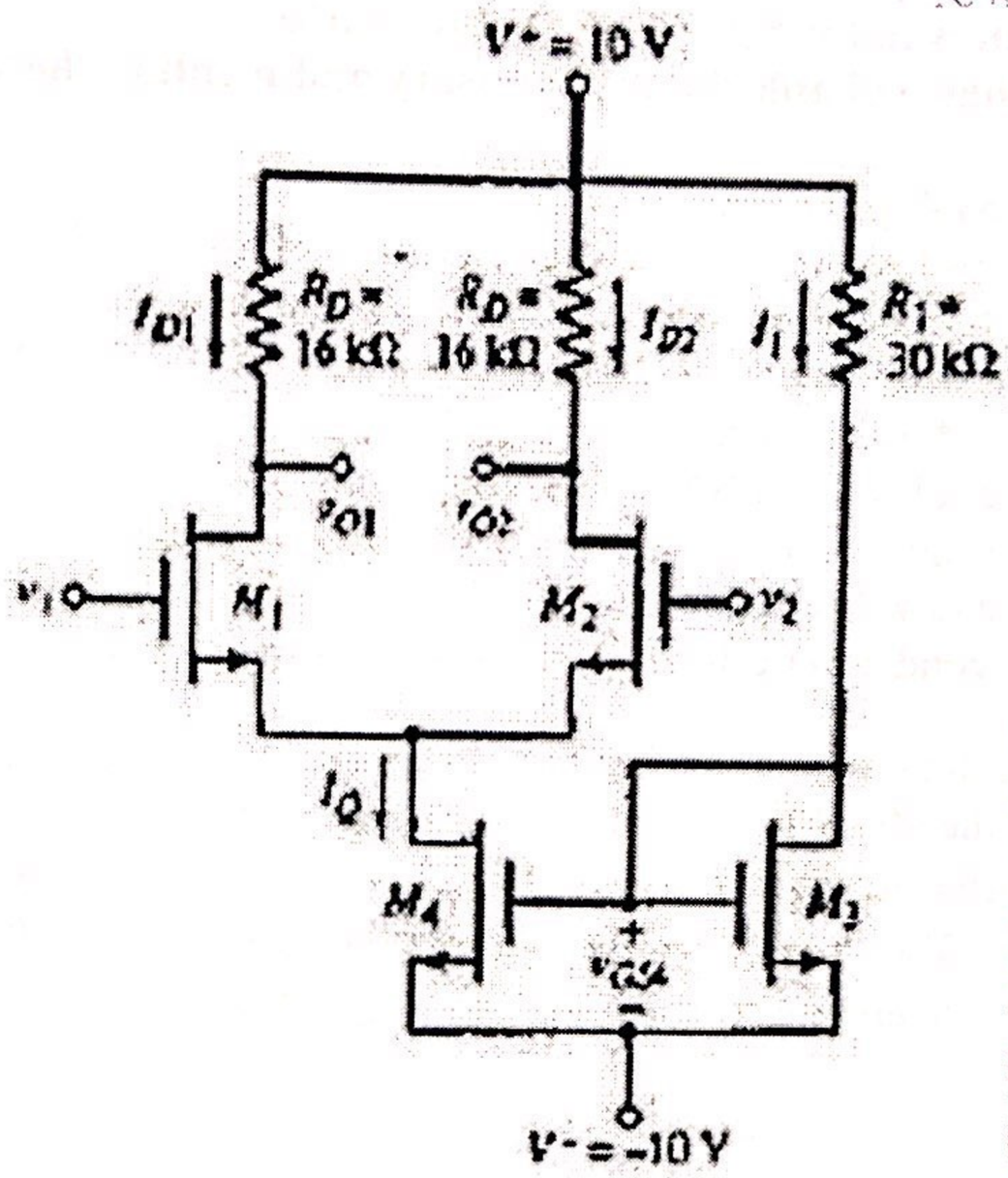

Fig. 3(a)

(b) With a neat circuit explain Bias Independent Current Source using MOSFET. [10]

Q.4 (a) For the circuit shown in Fig. 4(a), let $V_{DD} = V_{SS} = 1.5$ V, $V_{TN} = 0.6$ V, $V_{TP} = -0.6$ V, all channel lengths = 1 μm, $k_n' = 200$ μA/V^2, $k_p' = 80$ μA/V^2, and $\lambda = 0$. For $I_{REF} = 10$ μA, find the widths of all transistors to obtain $I_2 = 60$ μA, $I_3 = 20$ μA, and $I_5 = 80$ μA. It is further required that the voltage at the drain of Q_2 be allowed to go down to within 0.2 V of the negative supply and that the voltage at the drain of Q_5 be allowed to go up to within 0.2 V of the positive supply. [10]

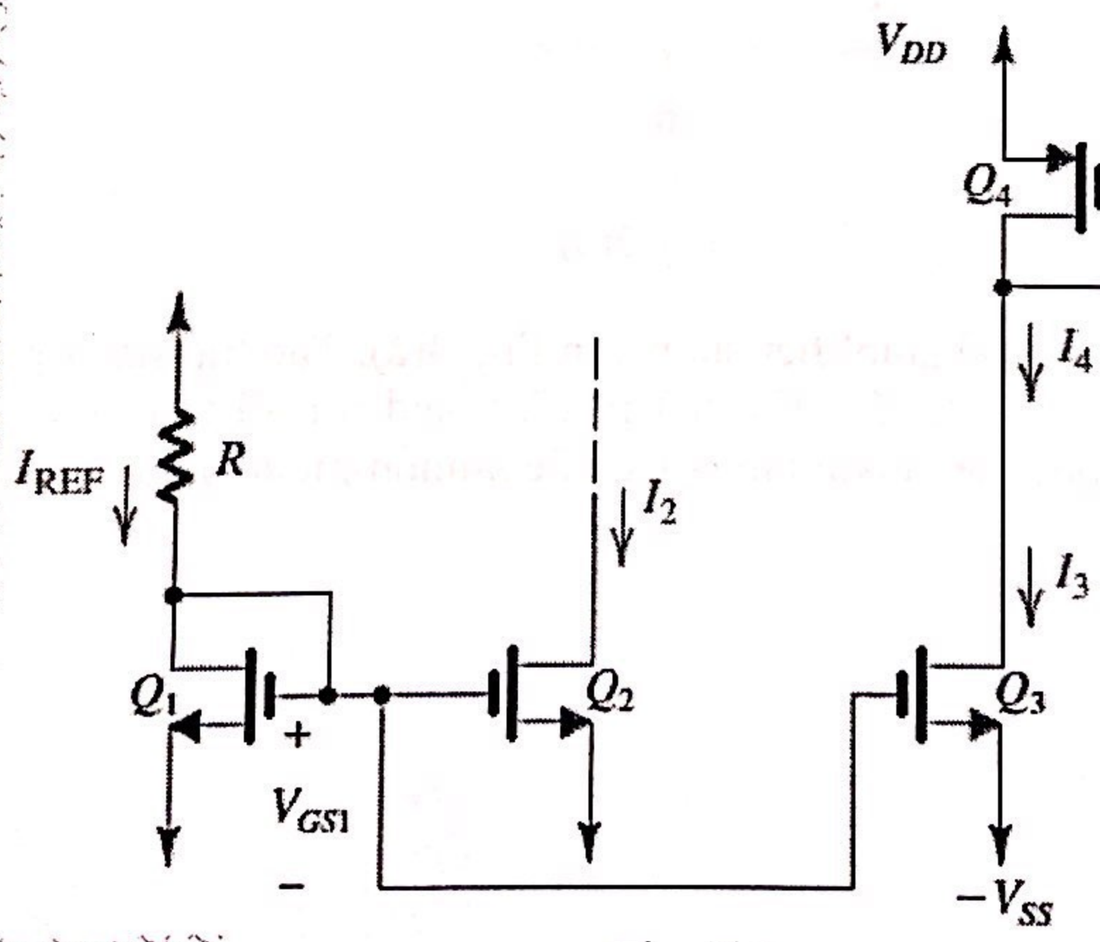

Fig. 4(a)

P.T.O

(b) Draw a small signal equivalent structure of Diff-amp and derive the equation for its CMRR. [10]

Q.5 (a) Draw a neat diagram of Class B power amplifier. Derive equation for its efficiency. [10]

(b) A CS amplifier utilizes an NMOS transistor with L=0.36 µm and W/L=10; it was fabricated in a 0.18-µm CMOS process for which $\mu_n C_{ox}$ = 387 µA/V^2 and V_A' = 5 V/µm. Find the values of g_m and A_0 obtained at I_D = 10 µA. [10]

Q.6 Short notes on: **(Attempt any four)** [20]

(a) Short channel effects in MOSFET.
(b) Wilson Current Mirror.
(c) MOS device capacitances.
(d) Folded cascode MOS amplifier.
(e) Fabrication of inductors.

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1T01025 - T.E.(ET)(Sem V) (Choice Based) / 32201 - Micropocessor & Peripherals Interfacing

(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 need of Assembler and compiler and their comparison. 05M

Q. 1(b) Draw and Explain the Flag register of 8086µp? 05M

Q. 1 (c) Write a program to display "P" on the screen of IBM PC. Use INT 21H function AH =02 and DL= character to display. Explain the logic of the program. How will you alter the character to be displayed? 05M

Q.1 (d) If 32K RAM (2 chips of 16K each) are interfaced with 8086. Assuming that last physical address of RAM is FFFFFH, what will be starting and end address of each chip? 05 M

Q.2 (a) Explain Maximum mode of 8086 µp. Draw timing diagram for Read operation in maximum mode. 10 M

Q.2 (b) Write a program to find maximum number from an array of 10 numbers. Assume that the numbers are 8 bit wide. 10 M

Q.3 (a) Describe the importance of 8257 DMA controller. Explain the Data transfer modes of 8257 DMA controller 10 M

Q.3 (b) Write a program to find strength of Even and Odd numbers among the series of 10 numbers. 10 M

Q.4 (a)Draw and Explain the interfacing of Math co-processor with 8086. 10 M

Q.4 (b) Draw and Explain the interfacing of ADC 0809 with 8086 Microprocessor using 8255. 10 M

Q.5 (a) Suggest hardware and write a program to generate a square wave at the output of DAC 08 which is interfaced with 8086 CPU. How will you ensure bottom edge of 0 V and upper edge

of 3.6 V for the square wave generated? Comment on method of changing the frequency of the square wave generated. 12 M

Q.5 (b) Draw and explain the Block diagram of microprocessor based system. 08M

Q.6 (a) Design an 8086 based system with 32K ROM (2 chips of 16K). Draw the memory map of the system designed. 10 M

Q.6 (b).Explain salient features of Programmable Interval Timer 8254. What are different modes of operations ? Explain in brief. 10 M

QP CODE : 22616

(3 Hours) **Marks : 80**

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

Q1 (a) Explain the Hazards of Electromagnetic Radiation. 20

(b) Explain the radiation mechanism of antenna with single wire system.

(c) Explain the use of Richard transformation and Kurodas Identity in RF filter design

(d) Derive an expression for array of two isotropic sources with same amplitude and in phase.

Q2 (a) Explain the RF behavior of resistor, capacitor and inductor. 10

(b) Discuss the design procedure for filter using image parameter method. 10

Q3 (a) Design a maximally flat LPF with a cut off frequency of 2 GHz. The generator and load impedance is 50 Ω with 15 dB insertion loss at 3GHz with discrete LC components. 10

(b) Derive an expression for array factor of N element linear array, where all elements are equally fed and spaced. Also find the expression for the position of principle maxima, nulls and secondary maxima. 10

Q4 (a) A radio link has 15 watt transmitter connected to an antenna of 2.5 m^2effective aperture at 5 GHz. The receiving antenna has an effective aperture of 0.5 m^2 and is located at a15 km line of sight distance from transmitting antenna. Assume lossless antennas. Find power delivered to the receiver. 10

(b) Derive an expression for E field and H field of infinitesimal dipole antenna 10

Q5 (a) What is folded dipole Antenna? Draw its typical structure and explain working mechanism. Give its advantages. 10

(b) What is Dolph- Chebyshev array? Explain the steps involved in design of Dolph-Chebyshev array. 10

Q6. **Write short notes** 20
(a) Ground effects on Antenna
(b) Log periodic Antenna
(c) Loop antenna
(d) Horn antenna

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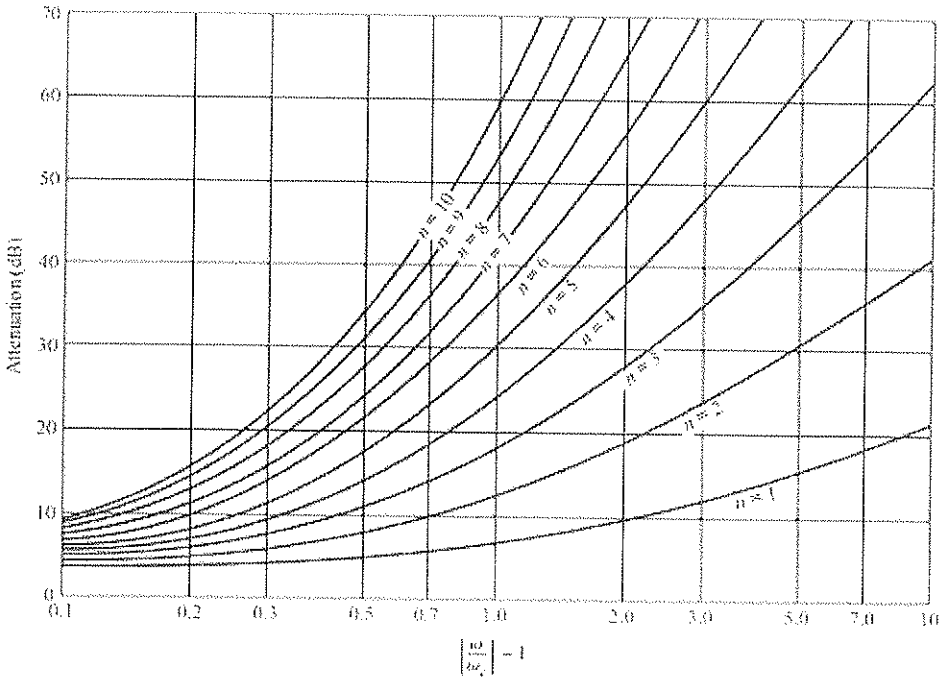

Attenuation versus normalized frequency for maximally flat filter prototypes.

Adapted from G. L. Matthaei, L. Young, and E. M. T. Jones, *Microwave Filters, Impedance-Matching Networks, and Coupling Structures*, Artech House, Dedham, Mass., 1980, with permission.

Element Values for Maximally Flat Low-Pass Filter Prototypes ($g_0 = 1$, $\omega_c = 1$, $N = 1$ to 10)

N	$g1$	$g2$	$g3$	$g4$	$g5$	$g6$	$g7$	$g8$	$g9$	$g10$	$g11$
1	2.0000	1.0000									
2	1.4142	1.4142	1.0000								
3	1.0000	2.0000	1.0000	1.0000							
4	0.7654	1.8478	1.8478	0.7654	1.0000						
5	0.6180	1.6180	2.0000	1.6180	0.6180	1.0000					
6	0.5176	1.4142	1.9318	1.9318	1.4142	0.5176	1.0000				
7	0.4450	1.2470	1.8019	2.0000	1.8019	1.2470	0.4450	1.0000			
8	0.3902	1.1111	1.6629	1.9615	1.9615	1.6629	1.1111	0.3902	1.0000		
9	0.3473	1.0000	1.5321	1.8794	2.0000	1.8794	1.5321	1.0000	0.3473	1.0000	
10	0.3129	0.9080	1.4142	1.7820	1.9754	1.9754	1.7820	1.4142	0.9080	0.3129	1.0000

Source: Reprinted from G. L. Matthaei, L. Young, and E. M. T. Jones, *Microwave Filters, Impedance-Matching Networks, and Coupling Structures*, Artech House, Dedham, Mass., 1980, with permission.

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

Note:
1. **Question No. 1 is compulsory.**
2. **Out of remaining questions, attempt any three questions.**
3. **Assume suitable additional data if required.**
4. **Figures in brackets on the right hand side indicate full marks.**

1. (A) State Central limit theorem and give its significance (05)
   (B) State the three axioms of probability. (05)
   (C) State and explain Bayes Theorem. (05)
   (D) Define Power spectral density and prove any two properties. (05)
2. (A) Prove that if input to LTI system is w.s.s. then the output is also w.s.s. (10)
   (B) In a factory, four machines A_1, A_2, A_3 and A_4 produce 35%, 10%, 25% and 30% of the items respectively. The percentage of defective items produced by them is 3%, 5%, 4% and 2%, respectively. An item is selected at random. (10)
   (i) What is the probability that the selected item will be defective?
   (ii) Given that the item is defective what is the probability that it was produced by machine A_4?
3. The joint probability density function of two random variables is given by (20)
   $f_{x,y}(x,y) = 15e^{-3x-3y} : x \geq 0, y \geq 0$
   i) Find the probability that $x<2$ and $y>0.2$.
   ii) Find the marginal densities of x and y.
   iii) Are x and y independent?
   iv) Find $E(x/y)$ and $E(y/x)$.
4. (A) A stationary process is given by $X(t) = 10 \cos [100 t + \theta]$ where θ is a random variable with uniform probability distribution in the interval $[-\prod, \prod]$. Show that it is a wide sense stationary process. (10)
   (B) Explain Strong and weak law of large numbers. (05)
   (C) Write short notes on the following special distributions. (05)
   i) Uniform distribution.
   ii) Gaussian distribution.
5. (A) Define discrete and continuous random variables by giving examples. Discuss the properties of distribution function. (10)
   (B) A random variable has the following exponential probability density function: $f(x) = Ke^{-|x|}$. Determine the value of K and the corresponding distribution function. (10)
6. (A) Suppose X and Y are two random variables. Define covariance and correlation of X and Y. When do we say that X and Y are (10)
   (i) Orthogonal,
   (ii) Independent, and
   (iii) Uncorrelated?
   Are uncorrelated variables independent?
   (B) State and prove Chapman-Kolmogorov equation. (10)

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Time: 3 Hours **Maximum Marks:80**

Note:
1. Question no. 1 is compulsory.
2. Out of remaining questions, attempt any 3 questions.
3. In all 4 questions to be attempted.
4. All questions carry equal marks.
5. Answer to each new question to be started on a fresh page.
6. Figure in brackets on the right hand side indicate full marks for a question.
7. Illustrate answer with neat diagrams wherever necessary.

Q1. Attempt **any 4** from the following:- [20]

a) Draw the block diagram of monochrome TV transmitter and explain its working.

b) What do you understand by compatibility in television system? What are the requirements to be considered to make colour TV system fully compatible for?

c) Compare PAL and NTSC television systems. (Five significant points of comparison)

d) What is difference between component video and composite video? Explain.

e) What is MAC signal? What are its advantages?

Q2 a) Draw and explain Image Orthicon type camera tube in detail. [10]

b) Explain the concept of frequency interleaving in television system. [10]

Q3 a) With the neat labeled diagram explain the NTSC receiver operation. [10]

b) What is Chroma subsampling? Explain the concept of Chroma subsampling with its types. [10]

Q4 a) What are different standards for video compression? With the help of neat diagram explain MPEG-2 principle. [10]

b) Draw and explain satellite television communication system. [10]

Q5 a) Explain IPTV with respect to architecture, internet protocols used, advantages and limitations. [10]

b) What is CCTV? Draw its block diagram and explain its principle of operation. [10]

Q6 a) Write short note on **any two**: [10]

i) Chrome cast
ii) Set-Top-Box
iii) HDTV standards & compatibility
iv) DVB-H standard

b) Explain the working principle of LED display with diagram and compare LED and LCD type of television displays. [10]