Course Name	:	*Digital Communications*		Mid Term Exam	
Course Code	:	*ECE 421*		Date	: *9/11/2019*
Level	:	*Fourth Year*	Faculty of Engineering	Time	: *35 minutes*
Department	:	*Electronics &Communications*	Zagazig University	No. of pages	: *1*
Term No.	:	*1*		No. of Questions	: *1*

PART II

الحل فى ورقة إجابة منفصلة

Question1: *20 MARKS*

1) Twenty-three voice signals, that have a maximum frequency of 4 KHZ, are sampled uniformly and then time division multiplexed. The sampling operation uses flat samples with 0.5 μsec duration. The multiplexing operation provides for synchronization by adding an extra pulse of 0.5 μsec duration. Assuming sampling rate is 2.5 times of the maximum signal frequency. **[6 marks]**
   (a) Calculate spacing time between two successive pulses of multiplexed signal and setup a scheme for accomplishing a multiplexing requirement.
   (b) Calculate the bit rate and the minimum transmission bandwidth for the multiplexed signal.
2) Your USB drive has a capacity of 109 bytes (1 gigabyte). You wish to store a digital representation of 4-kilohertz speech signal on this drive. Using a PCM representation, **[6 marks]**
   (a) Determine the maximum recording duration in hours for, with eight bits per sample.
   (b) Find SNR in dB if the voice signal is uniformly distributed between ±5V.
   (c) Find the No. of quantization bits that achieves SNR at least 60 dB.
3) Define the signal crest factor, and then deduce the relationship between SNR in dB and the signal crest factor in a PCM system. **[4 marks]**
4) Consider a test signal m(t)=2 sin(2π*200t) +10t . Determine the minimum step size δ for delta modulation of this signal to avoid slope overload distortion if the sampling rate is eight times of the Nyquist rate. **[4 marks]**

Best Wishes

Course Name	: *Digital Communication*		Mid-Term Exam		
Course Code	:		Date	:	*9/11/2019*
Level	: *Fourth Year*		Time		*75 minutes*
Department	: *Electronics & Communication*	Faculty of Engineering	No. of Pages	:	*1*
Term No.	: *1*	Zagazig University	No. of Questions	:	*2*

Part 1:

Question 1:

a. For the waveform

$$v(t) = A\cos(\omega t + \theta)$$

Where A and ω are not random, and θ is uniformly distributed between 0 and 2π.

Find the autocorrelation and the total average power of the waveform.

b. A noisy transmission channel has a bit error probability of 0.001, Calculate the probability of having 4 errors in a 10 digit code word.

c. A Gaussian density has mean of -2 and variance of 9. Find the probability that the random variable is between -5 and -2

d. A stochastic process y(t) with mean value m_y and autocorrelation $R_{yy}(\tau)$. If z(t)=y(t)-y(t-T)-y(t-2T), find the mean and the autocorrelation function of the process z(t).

e. Explain the difference between the cross-correlation and the convolution operations.

Course Name	: *Digital Communication*		Final Exam		
Course Code	: -		Date	:	*12/1/2020*
Level	: *Fourth Year*		Time	:	*3hr.for the two parts*
Department	: *Electronics& Communications*	Faculty of Engineering Zagazig University	No. of pages	:	*2*
Term No.	: *1*		No. of Questions	:	*2*

PART 1

Question1:

a. Binary Symmetric Channels (BSCs) can be used to derive some important transmission-error probabilities. They can be used to verify that the noise behavior in digital systems contrasts sharply with its behavior in analog systems as the transmission distance increases. Prove that for n binary symmetric channels in tandem, the overall probability of bit error is n times the bit error rate for a single BSC.

b. A digital communication system has a symbol alphabet consisting of six entries with transition matrix as shown below.

$$\begin{bmatrix} \frac{1}{6} & 0.1 & 0.1 & 0.1 & 0.1 & 0.1 \\ \frac{1}{6} & 0.5 & 0.1 & 0.1 & 0.1 & 0.1 \\ \frac{1}{6} & 0.1 & 0.5 & 0.1 & 0.1 & 0.1 \\ \frac{1}{6} & 0.1 & 0.1 & 0.5 & 0.1 & 0.1 \\ \frac{1}{6} & 0.1 & 0.1 & 0.1 & 0.5 & 0.1 \\ \frac{1}{6} & 0.1 & 0.1 & 0.1 & 0.1 & 0.5 \end{bmatrix}$$

i. Find the probability of a single transmitted symbol being in error, assuming that all symbols are equally probable.

ii. Find the probability of correct symbol transmission.

iii. Find the probability that exactly 2 symbols out of a 10 symbol message are in error.

c. Explain with drawing four line coding techniques; state the advantages and disadvantages of each technique.

d. Consider a system in which the transmitted voltage is corrupted by additive atmospheric noise. If the receiver receives anything above 0.5 volt, it assumes that a one was sent, and is zero otherwise. When the input is a binary 0, the received signal is a Gaussian random variable with mean zero and variance of unity. When the input is a binary 1 , the received signal is a Gaussian random variable with mean unity and variance of unity. Find the probability of bit error.

Question 2:

a. Consider a channel capacity in the presence of additive white Gaussian noise with power spectral density No watts/Hertz. Derive an equation for the channel capacity as the bandwidth B of the channel goes to infinity.

b. Consider an AWGN channel with 4 kHz bandwidth, and $No/2=10^{-12}$ W/Hz. The signal power required at the receiver is 0.1 mW. Calculate the capacity of this channel.

c. Find the Shannon code for the messages with probabilities 0.2, 0.2, 0.3, 0.15, 0.15. Calculate the efficiency of the code.

d. An 8-bit code word is formed by adding 4 parity bits to the 4 information bits. The parity bits are given by

C1=a1⊕a2 C2=a1⊕a3 C3=a2⊕a4 C4=a3⊕a4

i. Find the minimum distance between code words.

ii. How many errors can be detected? How many errors can be corrected?

iii. If the received code word is 1000 111, find the transmitted code word?

iv. With certain transmission rate R bits/sec over a channel having a channel capacity bits/sec Shannon tell you that if you do enough work encoding the binary data train, you can achieve low probability of bit error, explain.

Course Name	:	*Digital Communications*	Faculty of Engineering Zagazig University	Final Exam	
Course Code	:	*ECE 421*		Date	: *12/1/2020*
Level	:	*Fourth Year*		Time	: *3 hours*
Department	:	*Electronics &Communications*		No. of pages	: *1/part*
Term No.	:	*1*		No. of Questions	: *2/part*

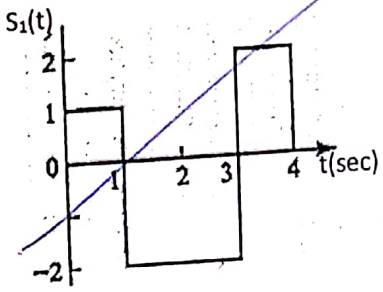
PART II (solve all the questions and assume any missing data)

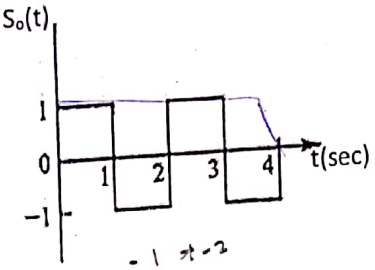
Question 1: [30 marks]

1) **For PAM/TDM system:** [6 marks]
   a. Sketch the full system block diagram.
   b. Explain how this system works.
   c. How synchronization is achieved between transmitter and receiver?
2) An 8-bit PCM encoder is designed to deal with an input signal that has a dynamic range of 2 volts. Find the signal to quantization noise power ratio (in dB) for an input signal= 0.5 cos $\omega_m t$. [4 marks]
3) Explain the block diagram of **PCM counting quantizer.** [4 marks]
4) Find the maximum input signal amplitude for avoiding slope overload distortion in a delta modulation system if step size is 0.5 volt and input signal operates at 200 Hz if the repetition period equals:
   a) 0.5 msec. b) 50 µsec. comment your answer [4 marks]
5) **Write short notes about:** [12 marks]
   1. Midriser & midtread quantizer. [4 M]
   2. Companding process. [4 M]
   3. Granular noise in DM. [2 M]
   4. DPCM principles. [2 M]

Question 2: [20 marks]

1) Given the two-baseband signals shown below. Assume $N_o = 2*10^{-3}$ W/Hz. [6 marks]
   a) Design a binary matched filter detector to choose between these baseband signals.
   b) Find the probability of bit error.





2) Check that if the square law detector can be used to demodulate BPSK signal. [4 marks]
3) How BASK signal is generated using: [4 marks]
   a. keying modulator b. traditional AM modulator
4) Matched filter can be used as coherent detector for BFSK demodulation: [6 marks]
   a. Design a matched filter to demodulate BFSK signal.
   b. Deduce the probability of bit error rate.

Best Wishes

PART II

Zagazig University
Faculty of Engineering

Subject: Electronic Applications
Course code : ECE 423
Level : 4th Year , Electronic & comm. Eng.
Electronic & communication Dept.

Term: 1 (2019/2020)
Time: 3 Hours (for the 2 parts)
No. of questions:
Final Term Exam

Part (B)

Attempt all questions — Assume any missing data

(1) a- Determine the luminance signal and the CDS for the following colors in the color TV system. Also calculate the amplitude and phase of the chrominance signal for the color which has R = 0.6 , G = 0.7 and B = 0.2

b- A four cavity Klystron has the following parameters : beam voltage = 10 KV, beam current = 0.7 Amp , operating frequency = 4 GHz , beam coupling Coefficient = 1 , dc electron beam current density = 5 x10^{-5} C/m^3 , signal voltage = 2V (rms), shunt resistance of the cavity = 10 KΩ . Calculate the plasma frequency and the reduced plasma frequency for R = 0.6 and the output power delivered to the load.

(13 degrees)

(2) a- Discuss the following :
i- Typical silicon IMPATT diodes.
ii- The process used by a T.V camera to convert a visual scene into a video signal.
iii- Block diagram of color T.V receiver.
b- Explain the physical structure and application of a cavity resonator and a magnetron.
c- How the NTSC composite video signal is generated?

(22 degrees)

(3) a- Explain how the luminance and chrominance signals are frequency interleaving in color T.V system.
b- Draw and discuss the operation of reflex klystron or Gunn diode .
c- Find the relation of G-Y to both B-Y and R-Y and discuss why G-Y is not chosen as a color difference signal in color T.V system .

(15 degrees)

Good Luck

PTO →

Course Name: Electronics Applications
No.of questions : 3
Level: 4th year
Dept. : Comm. &Electronics Eng.

Final Exam Part A
Date : 26/12/2019
Time: 3 H. (for the 2 parts)
No. of pages: One

Prof Dr. M.Fouad

Question (1)

(a) Write short notes about RF systems; its frequency ranges, its specifications, and its applications.

(b) Explain how cross modulation causes distortion in RF systems if the signal at w_2 is AM signal

(c) For square-law MOS transistor operating in saturation, the characteristic of Fig.1 can be expressed as

$$V_{out} = -\frac{1}{2}\mu_n C_{ox}\frac{W}{L}V_{in}\sqrt{\frac{4I_{SS}}{\mu_n C_{ox}\frac{W}{L}} - V_{in}^2}R_D.$$

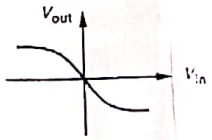


Fig. 1

If the differential input is small, approximate the characteristic by a polynomial.

(15 Mark)

Question (2)

(a) With drawing the superhetrodyne AM radio receiver Explain?

(b) Write short notes about:
i) Selectivity ii) Sensitivity iii) Transmission range iv) IF stage

(c) Consider an AM signal $S_{AM}(t)=(1+A\cos w_m t)\cos w_c t$ where The message signal frequency w_m=5 khz ,the carrier frequency w_c=100 khz , and the constant A =15. Can this signal be modulated by an envelope detector? What will be the output of the envelope? Find the frequency spectrum of the envelope detector output?

(15 Mark)

Question 3

(a) Explain with drawing:
i) Noncoherent detector ii) Costas loop

(b) Compare each pair of the following:
i. Time invariant systems and memoryless systems.
ii. Intermodulation and cross-modulation.

(c) A RF system measures IM3 distortion of -37 dB_c when a signal of 30 $mV_{peak\text{-}to\text{-}peak}$ is applied to the system. The system is required to process a signal at 2.4 GHz while two interferer signals exit at 2.42 and 2.44 GHz with amplitude of -40 dBm. Find the IIP_3 (dBm). Find also the minimum level (dBm) of the desired signal if the minimum ratio of the output desired signal level to the IM_3 level of the interferer at the output is 15 dB.

(20 Mark)

PTO →

Zagazig University
Faculty of Engineering

Subject : Electronic Applications
Course code : ECE 423
Level: 4th year, Electronics & Comm. Engineering
Electronics and Communication Dept.

Date : November 2019
Time: 75 min
No. of questions :4
Midterm Exam

Solve all the following questions **Assume any missing data**

Part 1

Question (1):-

a-) **Draw** the electromagnetic spectrum? **What** is meant by RF systems? and **What** are its applications?

b-) An amplifier senses a sinusoidal signal and delivers a power of 10 dB_m to load resistance of 50Ω. **Determine** the peak to peak voltage swing across the load?

Question (2):-

a-) **Explain** with drawing the expansive and compressive characteristics.

b-) An analog multiplier ideally producing $y(t)=k\, x_1(t)\, x_2(t)$, where k is a constant. Assume $x_1(t)= A_1 \cos(\omega_1 t)$ and $x_2(t)= A_2 \cos(\omega_2 t)$.

i) If the mixer is ideal, determine the output frequency components.

ii) If the input $x_2(t)$ suffers from 2nd and 3rd order nonlinearity, determine the output frequency components.

Zagazig University
Faculty of Engineering

Subject : Electronic Applications
Course code : ECE 423
Level: 4th year, Electronics & Comm. Engineering.
Electronics and Communication Dept.

Date : November 2019
Time: 75 min
No. of questions :4
Midterm Exam

Solve all the following questions **Assume any missing data**

Part 2

Question (1):-

a-) **On what basis** the numbers of scanning lines are chosen in TV systems. **Derive** a formula for that number.

b-) **Explain** with drawing the difference between sequential and interlaced scanning? And on what basis the resolution in TV systems is chosen.

Question (2):-

a-) **Find** the relation of G-Y to both B-Y and R-Y, which is found to be:
G-Y= -0.5 (R-Y) – 0.186 (B-Y). Then discuss why G-Y is not chosen as a CDS for transmission in TV systems

b-) **Derive** an expression for maximum video frequency required for the luminance signal assuming equal horizontal and vertical resolution for CCIR-TV system (625 lines and 25 frame rate), where **Kell** factor is 0.69 for the following two cases.

i) neglecting horizontal and vertical retrace times.
ii) taking into considerations retrace times.

Ministry of Higher Education
Zagazig University
Faculty of Engineering
Electronic and Communication Dept.

05/01/2020

First Semester - Final Exam
Course Name: Microwave Elec. Eng.
Course Code: ECE 326
Time Allowed: 3 Hours

Answer the following questions on your answer booklet

Question # 1 (20 points)

1) **Briefly discuss**, with the aid of suitable diagram, Ridley Watkins- Hilsum (RWH) Theory and Two-Valley Model Theory

2) **Describe** the operating principles of the TRAPATT diode.

3) TRAPATT diode has the following parameters:

Doping concentration: $N_A = 2 \times 10^{15}\ cm^{-3}$

Current density: $J = 20\ kA/cm^2$

Calculate: The Avalanche-zone Velocity.

Question # 2 (20 point)

1) **Describe** the applications of the parametric amplifiers.

2) **Briefly discuss**, with the aid of suitable diagrams, the equivalent circuits for a parametric amplifier and Manely-Rowe configuration.

3) The figure of merit for a diode nonlinear capacitor in an up-converter parametric amplifier is 10, and the ratio of the output frequency f_o over the signal frequency f_s, is 25. The diode temperature is 350°K.

Calculate the maximum power gain in decibels.

Compute the noise figure F in decibels.

Determine the bandwidth (BW) for $\gamma = 0.4$.

Question # 3 (20 point)

1) **What** are the differences in the principle of operation between the basic two-cavity klystron and the multicavity klystron (support your answer with illustrative figures)?

2) A two-cavity klystron amplifier has the following parameters:

Beam voltage:	$V_o = 20\ kV$
Beam current:	$I_o = 25\ mA$
Beam resistance:	$R_o = 30\ K\Omega$
Operating frequency:	$f = 8\ GHz$
Spacing between the two cavities:	$d = 1\ mm$
Gap spacing in either cavity:	$L = 4\ cm$
Effective shunt resistance, excluding beam loading:	$R_{sh} = 40\ K\Omega$

Determine:

I. The input gap voltage to give maximum voltage V_2

II. The voltage gain, neglecting the beam loading in the output cavity.

III. The efficiency of the amplifier, neglecting the beam loading.

IV. The beam loading conductance and show that neglecting it was justified in the preceding calculations.

Question # 5 (20 points)

1) **Describe** the principle of operation for a normal cylindrical magnetron and its characteristics.

2) An X-band pulsed conventional magnetron has the following parameters:

Anode voltage:	$V_o = 5.5$ kV
Anode current:	$I_o = 4.5$ A
Operating frequency:	$f = 9$ GHz
Resonator conductance:	$G_r = 2 \times 10^{-4}$ mho
Loaded conductance:	$G_l = 2.5 \times 10^{-5}$ mho
Vane capacitance:	C = 2.5 pF
Power loss:	$P_{loss} = 18.5$ kW

Compute:

I. The angular resonant frequency

II. The unloaded quality factor Q_{un}

III. The loaded quality factor Q_l

IV. The external quality factor Q_{ex}

V. The circuit efficiency

VI. The electronic efficiency

Best wishes,
Dr. Mai F. Ahmed

Ministry of Higher Education
Zagazig University
Faculty of Engineering
Electrical Engineering Dept.

12/11/2019

Term Exam
Course Name: Microwave Elec. Eng.
Course Code: ECE 326
Time Allowed: 1.15 Hours

Answer the following questions on your answer booklet.

Question # 1 (5 points)

1) **Briefly discuss**, with the aid of suitable diagram, the modes of operation for Gunn diodes.

2) **A typical n-type GaAs Gunn diode has the following parameters:**
Threshold field 2200v/cm, applied field 3800 v/cm device length 20μm, doping concentration 2×10^{14} cm^{-3} and operating frequency 20GHz.

Compute:
i) The electrons drift velocity.
ii) The electron density.
iii) The negative electron mobility.

Question # 2 (5 points)

1) **Describe** the physical structure and the operation of the Read diode build in the p^+-n-i-n^+ structure.

2) **A Ku-band diode** has a pulsed-operating voltage of 100 v, a pulsed-operating current of 0.9 A and the efficiency is about 10%.

Calculate:
i) A. the output power.
ii) B. the duty cycle if the pulse width is 0.01 ns and the frequency is 16 GHz.

Question # 3 (5 points)

1) **Discuss** the difference between the carrier current $I_o(t)$ and the external current $I_e(t)$.

2) The carrier drift velocity v_d is 10^8 cm/s for silicon, **determine** the optimum operating frequency for a Read diode with an i-region length of 2.5 μm.

Question # 4 (5 points)

1) **Explain** the two effect of the IMPATT diode that combines to produce a 180 degree –phase difference between the applied voltage and the resulting current.

2) An IMPATT diode has the following parameters:

Carrier drift velocity:	$v_d = 2 \times 10^7$ cm/s
Drift-region length:	$L = 6\ \mu m$
Maximum operating voltage:	$V_{max} = 100$ V
Maximum operating current:	$I_{max} = 200$ mA
Efficiency:	15%
Breakdown voltage:	$V_{bd} = 90$ V

Compute: (a) the maximum output power in watts, (b) the resonant frequency in gigahertz.

Best wishes,
Dr. Mai Fouad Ahmed

Zagazig University
Faculty of Engineering
Subject : Measurements & testing(1)
Course code : ECE 422 a
Level: 4th year, Electronics & Comm. Engineering.

Date : November 2019
Time: 75 min
No. of questions :2
Midterm Exam
(1st term)

Solve all the following questions **Assume any missing data**

Question (1):-

a-) Draw and discuss the operation of voltage to frequency conversion.

b-) Draw and discuss the operation of:

i) Tuned RF receiver.

ii) Super heterodyne receiver.

Question (2):-

A-) Explain the following:

i) Intermediate frequency.

ii) Dual conversion receiver and Automatic Gain Control (AGC).

B-) Complete:

1- The mixer output in the super heterodyne, is usually the difference between the-Sig--frequency and the-If---frequency.

2- The AGC voltage controls the gain of the --If----amp---.

3- For best selectivity and stability, the IF should be----------.

4- An interfering signal that is spaced from the desired signal by twice the IF is called --Image.

5- A super heterodyne has an input signal of 15 MHz, and the LO is tuned to 18.5 MHz. The IF is --3.5----- MHz.

6- Images are caused by the lack of ---at the mixer input.

7- A desired signal at 27 MHz is mixed with an LO frequency of 27.5 MHz. the image frequency is 26.28 MHz

8- True or false, The LO may be above or below the signal frequency.

9- The main feature of a dual conversion super heterodyne is that it has two --mixer-- circuits.

10- The image problem can be solved by proper choice of the ----------.