Menoufia University
Faculty of Electronic Eng.ing
Departement of Industrial Electronics and control Engineering

الفرقة الثالثة اتصالات

Final Term Examination
For Industrial Electronics
For 3rd year students
Date: 3/6/2018. T.A. 3 Houres

Answer The Following Questions:-

1.a. Explain The operation of Shockly diode relaxation oscillator.

1.b. What is the time constant ($\tau$) of an 0.1 $\mu$F capacitor and a 100 k$\Omega$ resistor used in a relaxation oscillator?

2.a. Explain the operation of the elementary full-wave triac power control circuit.

2.b. Explain the operation of zero voltage Switch circuit

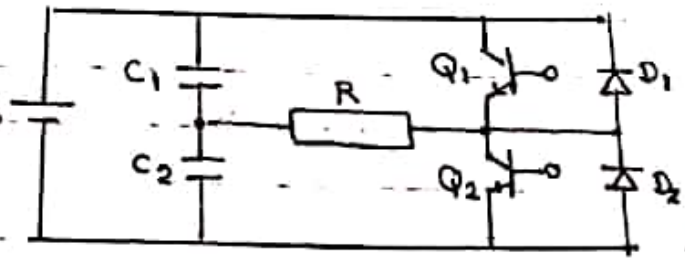
3.a. Explain the operation of Topology of a three-phase inverter with brake-chopper IGBT (Insulated Gate Bibolar Transistor).

3.b. The single-phase half-bridge inverter shown in Fig. has a resistive load R=2a-n and the DC input voltage Vs=200 Volt,

(i) Sketch the gating signals and output voltage.

(ii) Determine the total r.m.s output voltage and power

(iii) Derive the expressions of the instantaneous output voltage Vo and Current Io.




(iv) Find the average and peak current of each transistor &

(v) The peak-reverse blocking $V_{BR}$ voltage of each transistor.

(vi) Calculate the total harmonic distortion (THD) and distortion factor (DF) of the output voltage.

Please Turnover !!

بقية الأسئلة على الصفحة الأخرى !!

(c) Diffusion of generated carriers
(d) Forward bias

3C A solar cell at room temperature is under an illumination of 100 $Wm^{-2}$ and has a short circuit current, $I_{sc}$, of 50 mA and an open circuit voltage, $V_{oc}$, of 0.55 V. What are the short circuit current and the open circuit voltage when the light intensity is halved? Assume $\eta = 1$. [3]

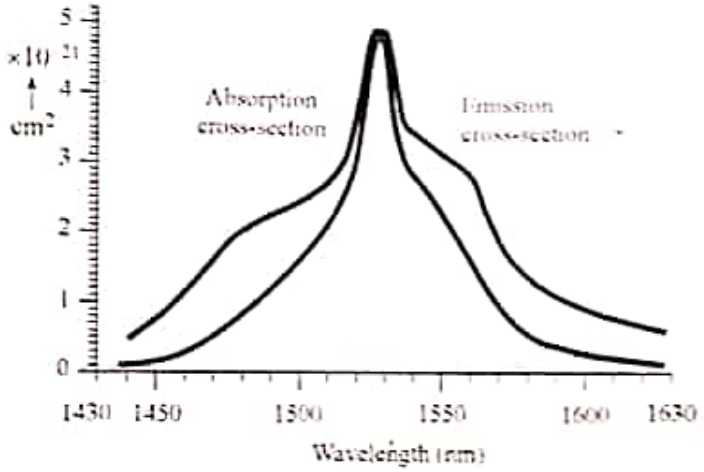
3D Heterojunction solar cells are generally more efficient than homojunction ones. Why? [2]

3E Sketch the solar cell equivalent circuit. What effects do series and shunt resistance have in photovoltaic systems? [3]

## QUESTION 4 [10 Marks]

OPTICAL AMPLIFIERS

4A A 3 m long EDFA has an Er concentration of $1 \times 10^{19}$ $cm^{-3}$ and is pumped at 1480 nm. Determine the small signal gain $G$ in dB at 1570 nm for full population inversion 100% and 70% inversion. [2]




4B (a) In stimulated emission, the_____, _____, _____, and wavelength(i.e. frequency or energy) of the emitted photon are the same as the incoming photon. [1.5]
(b) In lasers, the number of carriers in the excited state must be higher than the ground state. This is called _____. [0.5]

4C Draw a block diagram of an erbium-doped fiber amplifier (EDFA). State the function of each part of the EDFA. [3]

4D A particular EDFA has a small signal gain (G) of 20 dB, and is pumped at 30 mW at 980 nm. What is the maximum input signal power beyond which saturation effects take over? What is the corresponding maximum output power? [3]

*END OF EXAMINATION*

2B A four-port network has the scattering matrix shown as follows.

$$[S] = \begin{bmatrix} 0.17\angle 90^\circ & 0.6\angle 45^\circ & 0.4\angle 45^\circ & 0 \\ 0.6\angle 45^\circ & 0 & 0 & 0.3\angle -45^\circ \\ 0.4\angle 45^\circ & 0 & 0 & 0.5\angle -45^\circ \\ 0 & 0.3\angle -45^\circ & 0.5\angle -45^\circ & 0 \end{bmatrix}$$

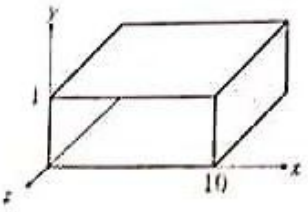
(a) Is this network lossless? Justify your answer. [2]
(b) Is this network reciprocal? Why or why not? [1]
(c) What is the return loss at port 1 when all other ports are terminated with matched loads? [1]
(d) What is the reflection coefficient seen at port 1 if a short circuit is placed at port 3 and all other ports are terminated with matched loads? [3]

## QUESTION 3 [20 Marks]

### RECTANGULAR WAVEGUIDES

3A A rectangular air-filled waveguide supports TE propagation mode (shown below). Assume that the following magnetic field in the z direction is obtained:

$$H_z = E_0 \cos\left(\frac{\pi x}{2}\right) \cos(\pi y)\, e^{-j\beta z}$$




(a) What is the mode of operation? [1]
(b) What are the cutoff wave number $k_c$ and the free-space wave number $k$? [2]
(c) Find the wave impedance for this waveguide? [2]
(d) Find $E_x$, $E_y$, $H_x$, and $H_y$. [3]

3B An X-band waveguide has a recommended frequency range of 8.20-12.4 GHz. This WR-90 waveguide has inside dimensions of $2.286 \times 1.016$ cm.
(a) What are the first three waveguide modes and their cutoff frequencies? [3]
(b) Why is the recommended frequency range of this waveguide given as 8.20-2.4 GHz? [2]
(c) Assume the wave is propagating in the z-direction. Write an equation for $E_z$ if all of the first three modes are propagating. [2]
(d) Assume the wave is propagating in the z-direction. Sketch the magnitude of the $E_y$ field for the first two modes of propagation. Show only the $x - y$ plane. [3]
(e) Sketch a method of feeding the $TE_{01}$ mode in a waveguide. Be sure to show where the feed point(s) are, what their orientation is, and what their relative phases are. [2]

## QUESTION 6 [10 Marks]

IMPEDANCE MATCHING

6 Use the provided Smith Chart to design a lumped element, lossless, L-section matching network to match a load impedance of $Z_L = (100 - j50)\ \Omega$ to a T-line with a characteristic impedance of $Z_0 = 50\ \Omega$ at a frequency of 1 GHz.
Draw the obtained matching networks with the elements and their values clearly indicated on each possible solution.

*END OF EXAMINATION*

## CONSTANTS

$\varepsilon_o = 8.854 \times 10^{-12}$ F/m, $\mu_o = 4\pi \times 10^{-7}$ H/m, $\eta_o = 377\ \Omega$, $c = 3 \times 10^8$ m/s

1 Np = 8.686 dB

## USEFUL FORMULAS

$$H_z = A_{mn} \cos\left(\frac{m\pi}{a}x\right)\cos\left(\frac{n\pi}{b}y\right)e^{-j\beta z}$$

$$E_x = \frac{-j\omega\mu}{k_c^2}\frac{\partial H_z}{\partial y}, \quad H_x = \frac{-j\beta}{k_c^2}\frac{\partial H_z}{\partial x}$$

$$E_y = \frac{j\omega\mu}{k_c^2}\frac{\partial H_z}{\partial x}, \quad H_y = \frac{-j\beta}{k_c^2}\frac{\partial H_z}{\partial y}$$

$$V_1^e = -j\frac{V_{g2}\sqrt{2}}{2}, \quad V_2^e = \frac{V_{g2}}{2}$$

$$V_1^o = 0, \quad V_2^o = \frac{r/2}{r/2+1}V_{g2}$$

$$L_k' = \frac{Z_0 L_k}{\omega_c}, \quad C_k' = \frac{C_k}{\omega_c Z_0}$$

$$\varepsilon_e = \frac{\varepsilon_r + 1}{2} + \frac{\varepsilon_r - 1}{2}\frac{1}{\sqrt{1 + 12d/W}}$$

For FR4 PCB:
$W/d = 16$ @ $Z_0 = 10\ \Omega$, $W/d = 1.98$ @ $Z_0 = 50\ \Omega$, and $W/d = 0.36$ @ $Z_0 = 110\ \Omega$

Table 8.3 – Maximally flat low-pass prototype filter.

| N | g1 | g2 | g3 | g4 | g5 | g6 | g7 | g8 | g9 |
|---|---|---|---|---|---|---|---|---|---|
| 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 |

| | Question No | Q1 | | | Q2 |
|---|---|---|---|---|---|
| | | a | | c | |
| Achieved ILOs | A- Knowledge & Understanding | a1,a8,a15 | a8 | a15 | a1,a8,a15 |
| | B- Intellectual skills | b1.b2,b12 | b2 | b12 | b1.b2,b12 |
| | C- Professional and practical skills | c1,c23 | c18 | | c1,c23 |
| | D- General and transferable skills | | | | |

| | | | | | |
|---|---|---|---|---|---|
| University | : | Menoufia | | Date | : 10 / 05 / 2018 |
| Faculty | : | Electronic Engineering | | Time | : 3 Hours |
| Department | : | Communications | | No. of pages | : 2 |
| Academic level | : | 3rd Year | | Full Mark | : 70 Marks |
| Course Name | : | Digital Signal Processing | | Exam | : Final Exam |
| Course Code | : | ECE 322 | | Examiner | : Prof. Adel Abdel Masieh |

**Answer all the following questions :**

***Question No 1 :*** **( 14 Marks)**

a) Determine the power and energy of the unit step sequence. ( 7 Marks)

b) Determine if the system $y(n) = x(1-n)$ is time variant or time invariant. ( 7 Marks)

***Question No 2:*** **( 14 Marks)**

a) Determine if the system $y(n) = x(2n-1)$ is causal or non-causal. ( 7 Marks)

b) Find the impulse response of the system

$$y(n) = b_o( x(n) + b_1 x(n-1) + b_2 x(n-2)$$ (7 Marks)

***Question No 3 :*** **( 14 Marks)**

a) Find the amplitude and phase responses of the system $y(n) = x(n) - x(n-7)$ ( 7 Marks)

b) Design a low pass FIR filter with order 4 and frequency response

$H(f) = 1 : 4\ KHz \geq f \geq 0$

and $H(f) = 0 : 8\ KHz \geq f > 4\ KHz$ ( 7 Marks)

***Question No 4 :*** **( 14 Marks)**

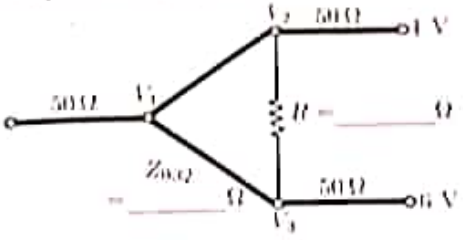
a) Use the simple high pass filter $H(S) = S / (S+1)$ and bilinear transformation to design a digital band stop filter with cut off frequencies 3.75 and 5 KHz, sampling frequency 15 KHz. (7 Marks)

b) The transfer function of a digital filter is given by $H(z) = (z-a) / (z-b$ Realize this filter using the cascade form . ( 7 Marks)

## QUESTION 4 [20 Marks]

POWER DIVIDERS AND DIRECTIONAL COUPLERS

4A (a) Design a Wilkinson Power divider for equal power combining. All input and output lines are 50 Ω. Specify $R$ and $Z_{0,Q}$ below. [2]



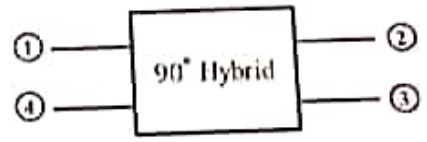

(b) If the input to port 2 is 1 V and the input to port 3 is 6 V, find: (Hint: you will need to use the results of Even and Odd analysis. Note: you have two sources so be smart).

$V_1$ = _____ V [2]
$V_2$ = _____ V [2]
$V_3$ = _____ V [2]
$I$ = _____ A [2]

4B (a) If a quadrature coupler has the following input voltages, what is the output voltage on port 4? [3]

$V_1^+ = 1\angle 30^\circ$ Volts
$V_2^+ = 2\angle 60^\circ$ Volts
$V_3^+ = 3\angle 90^\circ$ Volts
$V_4^+ = 4\angle 120^\circ$ Volts

$$[S] = \frac{-1}{\sqrt{2}}\begin{bmatrix} 0 & j & 1 & 0 \\ j & 0 & 0 & 1 \\ 1 & 0 & 0 & j \\ 0 & 1 & j & 0 \end{bmatrix}$$




(b) Does the result change when $V_1^+$ is changed to $1000\angle 30^\circ$ volts? Explain why or why not? [2]

4C (a) With the neat diagram only, show how one can construct a four port circulator using two magic tees. [2]

(b) With the neat diagram, explain the working of a two-hole directional coupler. [3]

## QUESTION 5 [10 Marks]

MICROWAVE FILTERS

5 Design a stepped-impedance, maximally flat low-pass filter having a cutoff frequency of 2.5 GHz and an attenuation of at least 15 dB at 4 GHz. Use a reference impedance of $Z_0 =$ 50 Ω. The highest practical line impedance is 110 Ω, and the lowest is 10 Ω.

Use a high-impedance line for the first section (closest to the source) and use the minimum number of sections capable of meeting the attenuation requirement.

Sketch your design, and clearly specify the electrical lengths, widths of each section, and impedances of all lines. Assume FR4 fiberglass PCB with $\varepsilon_r = 4.2$ and $d = 1.5$ mm.

Menoufia University
Faculty of Electronic Engineering
Industrial Elec. and Control Eng. Dept.
Final Exam, for 3rd year
Date: 27 May 2018

Digital Control Systems (ACE323)
Time Allowed: 3 H
Total marks: 100 marks
(20 marks/question)
No. of questions pages: 2 pages

**Answer the following four questions: -**

1) Consider the following linear difference equation:

$$y(k+2) - 1.3679\,y(k+1) + 0.3679\,y(k) = 0.3679\,u(k+1) + 0.2642\,u(k)$$

where $y(k)$ is the output and $y(k) = 0$ for $k \leq 0$ and where $u(k)$ is the input and is given by:

$$u(0) = 1,\ u(1) = 0.2142,\ u(2) = -0.2142, \text{ and } u(k) = 0 \text{ for } 3 \leq k < 0.$$

a) Determine the output $y(k)$.
b) Plot $y(k)$ for the first four samples.
c) Find the final value $y(\infty)$.

2-a) Obtain an expression for the sampled output $Y(z)$ from the block diagram shown in Fig. 1

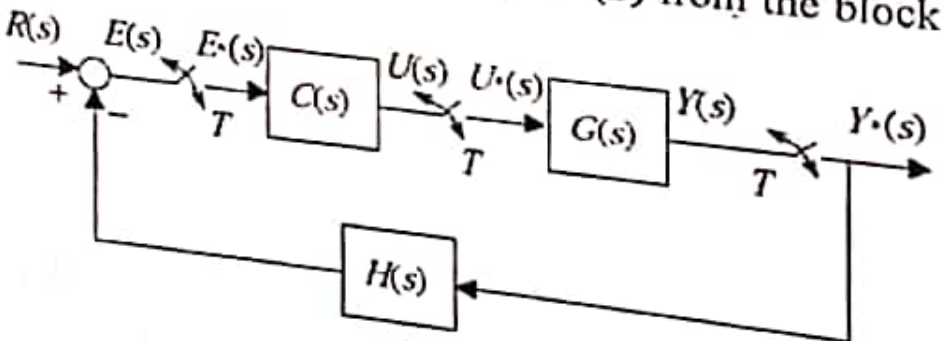



**Fig. 1**

2-b) A system is described by the following differential equation:

$$\ddot{y}(t) = u(t)$$

where $y(t)$ and $u(t)$ represent the output and the input of the system, respectively. If the sampling period is $T = 0.5s$.
(a) Find the discrete state space model for the system.
(b) Write a MATLAB code to find the discrete state space model for the system.

3) The open-loop transfer function of a system is given by:

$$G(s) = \frac{e^{-4s}}{1+2s}$$

(a) Design a dead-beat digital controller for the system. If the sampling
(b) Draw the block diagram of the system together with the
(c) Write a MATLAB code to find a dead-beat

**Part 2- Dr. Osama Elshazly** 45 Marks **Answer this part from the Left**

**Question No. (3):** **[5 Marks]**

➢ **True or False and correct the false ones?**

1. Inverse kinematics allows the goal's position and orientation that correspond to the set of joint angles to be calculated.
2. Trajectory planning is the way that robot is moved from one location to another in uncontrolled manner.
3. In Cartesian Space description, the motion to be made by the robot is described by its joint values.
4. Blending the motion is not a solution for the jerky motion caused by the stop and go motions of a robot moving from point A to point C passing through point B.
5. To plan the motion which a manipulator performs to move from point A to another point B in unlimited time, this is called trajectory planning.

**Question No. (4):** **[10 Marks]**

➢ **Choose the correct answer:**

1- In trajectory planning, the maximum acceleration is function of .....
a- initial & final position b- final & initial time c- Both a and b d- none of the above

2- In trajectory planning, the blending time is function of .....
a- initial & final position b- final time & cruising velocity c- Both a and b d- none of the above

3- Links can be classified depending upon the number of points of attachments into .....
a- Rigid b- Flexible c- Fluid d- none of the above

4- Higher kinematic pairs are those where the two links have ..... contact between them.
a- surface b- area c- point d- both a and b

5- Radial follower is a mechanism in which the follower motion axis and the cam center are .....
a- identical b- away from each other c- both a and b d- none of the above

6- In compound gear train consists of one driver with teeth $T_1$, one driven with teeth $T_4$ and two compound gears with teeth $T_2$ and $T_3$, the gear ratio depends on.....
a- $T_1$ and $T_4$ b- $T_1$ and $T_2$ c- $T_1$ and $T_3$ d- $T_1$, $T_2$ and $T_4$ e- $T_1$, $T_2$, $T_3$ and $T_4$

7- The torque transmitted by a belt drive is due to the ..... in tight and slack side tensions.
a- differences b- similarities c- phase shift d- none of the above

8- In open-belt drive, the driven pulley and the driving pulley have the .....direction of rotation.
a- same b- opposite c- parallel d- perpendicular

9- Gear train cannot be classified depending upon the arrangement of wheels as .....
a- simple and compound b-reverted and planetary c- radial and offset d- both a and

10- The cam followers can be classified based on axis of the cam and the follower as ..... and .....
a- radial b- offset c- reciprocating d- oscillating e- both a and b f- both c an

## Answer All the Following Questions

**1- The following questions are multiple choices. Please Select Best One from (A)-(D).**

**I- Grid Computing is -------.**

(A) an artificial intelligence. (B) a science-fictional panacea.
(C) an advanced networking technology. (D) a network of computation.

**II- Which of the following is not belongs to basic QoS architecture --------.**

(A) QoS Collision Management. (B) QoS Identification and Marking.
(C) QoS Within a Single Network Element. (D) QoS Policy and Management.

**III- Li-Fi was created as an alternative to --------.**

(A) MW (B) IR (C) RF (D) ISM

**IV- Which of the following is not one of the controls/countermeasure classes,--------.**

(A) Procedural or Administrative . (B) Physical Controls.
(C) Protocols or Command. (D) Technical Controls.

**V- Which of the following URL is not FQDN -------.**

(A) mechanical.iit.col (B) Challenger.atc.fhda.edu
(C) arc.fifa.org (D) www.funny.int

**VI- The interface between the NIC and the SPX/IPX stack is -------.**

(A) Network Core Protocol. (B) Open Data-link Interface.
(C) NetWare Shell. (D) Service Advertising Protocol.

**VII- Which of the following protocol is not within DoD's IP Layer -------.**

(A) ICMP (B) SCTP (C) IGMP (D) RARP

**VIII- ATM's --------.is used to provide guidance to the network in the event of congestion.**

(A) VCI (B) VPI (C) GFC (D) CLP

**IX- Which of the following is not one of the ISDN's Bearer services,-------.**

(A) Cell relay . (B) Circuit switching.
(C) Packet switching. (D) Message handling.

**X- The ------ within BPL system used to retrieve high, medium and low signals.**

(A) Extractors . (B) Injectors
(C) Repeaters (D) Power grid

[10-mark

**2- Choose (T) for the true sentence and (F) for the false sentence, Write the correct**

**Part 2- Dr. Osama Elshazly** 45 Marks **Answer this part from the Left**

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Menoufia University
Faculty of electronic Engineering
Time: Three hours

Elective Course
Information Security System
Communication Dept.
Third Year, 2nd semester

➡ Start each answer in a new page and from left to right.

**Q1.**

A) Explain the symmetric encryption model and what are the requirements for high security?

B) Illustrate the operation of single round of Data Encryption Standard (DES) algorithm?

C) Explain IEEE 802.11 Extended Service Set? and association related services?

D) Use the ADFGVX cipher with the key-word ENCRYPT and the array given below to

(i) Encrypt GO SOUTH

(ii) Decrypt AVAV VXXD VAVD VXDX VDVX GVFV GXXF

| | A | D | F | G | V | X |
|---|---|---|---|---|---|---|
| A | F | L | 1 | A | U | 2 |
| D | J | D | W | 3 | C | U |
| F | C | I | Y | B | 4 | P |
| G | R | 5 | Q | 8 | V | E |
| V | 6 | K | 7 | Z | M | X |
| X | S | N | H | 0 | T | 9 |

**Q2.**

A) Explain four stages of each round in Advanced Encryption Standard (AES)?

B) Define security policy database and security association database?

C) Compare between Cipher Modes in Fig. 1 and Fig. 2? What are names, operation, advantages and applications?

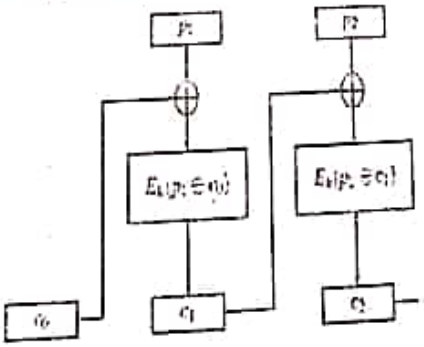


Fig. 1

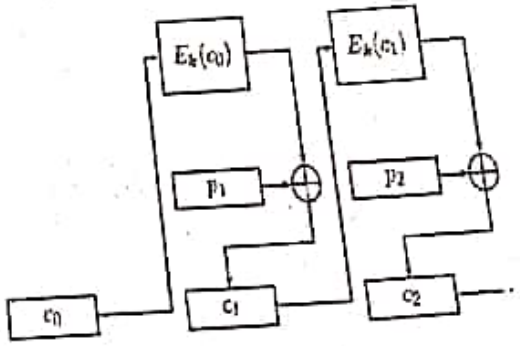


Fig. 2

D) Using digital signature standard (DSS) with $p = 1031$, $q = 103$ and $h = 14$. The user private key $x = 70$ and random integer $k = 25$. The message hash value is $H(M) = 500$. Find a digital signature $(r, s)$ and how to verify it.

*Note:* $g = h^{(p-1)/q} \bmod p$ , $y = g^x \bmod p$, $r = (g^k \bmod p) \bmod q$, $u_1 = [s^{-1}H(M)] \bmod q$

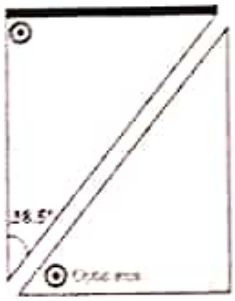
$s = [k^{-1}(H(M) + xr)] \bmod q$, $u_2 = [s^{-1}r] \bmod q$ , $v = [(g^{u_1}y^{u_2}) \bmod p] \bmod q$



Follow p

1E Sketch (only) how you can construct an LCD cell that is normally black and becomes bright upon the application of an ac voltage. [3]

1F The following figure shows the cross-section of a **Glan–Foucault prism** with the optical axes marked. The prism is of calcite with $n_o = 1.658$ and $n_e = 1.486$ with a prism angle of 38.5°. Unpolarized light is impinging from left. Draw the directions of rays through the prism with an accurate mark of the polarization states (• and ↕) showing which ray will emerge out and which one will be totally reflected. Justify your answer. [3]




*Answer only Two* ⚠

## QUESTION 2 [10 Marks]

### IMAGE SENSORS

2A A digital camera uses a CCD sensor has a 1K(H)×2K(V) pixel matrix.

I. What the total time to transfer one frame of the image (using full frame read-out technique) when the data transfer rate is 20 kHz? Is this time compatible with the processing of 30 frames/s? [2]

II. Repeat (a) for frame read-out technique. [2]

2B Define the image sensor fill factor (FF)? Why small FF is not desirable? [2]

2C List the three color rendering methods used in image sensors? Draw only one method. [2]

2D Is it possible to only read out a small portion say 10 × 10 pixels window (region-of-interest) of a larger CCD sensor? How is this different from a CMOS sensor? [2]

## QUESTION 3 [10 Marks]

### PHOTOVOLTAIC DEVICES: SOLAR CELLS

3A Which of the following techniques may be used to enhance crystalline solar cells efficiency? [1]

(a) Increasing the thickness of the antireflection coating layer.
(b) Surface passivation to prevent carrier trapping.
(c) Forming a tandem architecture by positioning lower band gap over the higher band gap absorber layers.
(d) Both (b) and (c).

3B Photocurrent in the solar cell is due to [1]

(a) Lowering of barrier height for diffusion upon optical absorption
(b) Drift of minority carriers generated during absorption

5. If $x^*$ is a local maximum; a change in the function for any move in a small neighborhood of $x^*$ must be:
   a. strictly positive
   b. non-positive
   c. strictly negative
   d. non-negative
6. For an equaltiy constraints $h_j(x)$, it is said to be active at a design point $x^*$ when
   a. $h_j(x^*) = 0$
   b. $h_j(x^*) < 0$
   c. $h_j(x^*) > 0$
   d. none of the above
7. The Hessian matrix of a function $f(x)$ is calculated using
   a. the first derivatives of the function
   b. the second derivatives of the function
   c. the third derivatives of the function
   d. a & b
8. Taylor series expansion for a function at a point uses
   a. the function value
   b. the function derivatives
   c. a & b
   d. none of the above
9. Solving a constrained optimization problem by KKT conditions, each case defined by the switching conditions can have
   a. only one solution
   b. only two solutions
   c. multiple solutions
   d. none of the above
10. A symmetric matrix $A$ is a positive semidefinite if its eigenvalues are
   a. strictly positive
   b. non-negative
   c. strictly negative
   d. non-positive
11. The gradient vector for a function is calculated using
   a. the first derivatives of the function.
   b. the second derivatives of the function.
   c. the third derivatives of the function.
   d. a & b
12. A quadratic form is a special nonlinear function that have
   a. first-order terms
   b. second-order terms
   c. third-order terms
   d. fourth-order terms

Menoufia University
Faculty of Electronic Eng.
Dep. of Ind. Electronics and Control Eng.

Final Term Exam – 3rd year (2017/2018)
Robotics – ACE322
Time Allowed: 3 Hours
30-5-2018

**Answer the following questions:**

**Part 1- Dr. Tarek Y. Khedr** 25 Marks **Answer this part from the Right**

**Question No. (1):** [10 Marks]

**A point P=(1,2,3)T is attached to a frame F. The frame is subjected to the following transformations:**

1- Rotation of 90° about the Y-axis,
2- followed by a translation along (n,o,a) of (1,2,3),
3- followed by a translation along (x,y,z) of (4,5,6),
4- and finally followed by a rotation of 90° about the O-axis

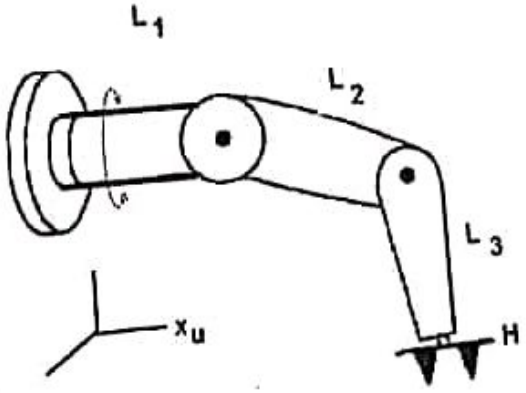
A) Write the transformation matrix for each one of these transformations.
B) Write the Equation to give the final position of the point P after these transformations.
C) Write the Equation to give the final position and orientation of the frame F after these transformations.

[15 Marks]

**Question No. (2):**

**A. For the robot in the following figure:**

A.1) Draw the suitable coordinate frames for each joint using D-H representation.
A.2) Fill out the D-H parameters table for that robot.




B. A camera is attached to the 4th link of a robot, it observes an object and determines its frame w.r.t the camera's frame. If the following transformations ( ${}^{4}T_{cam}$ , ${}^{4}T_{H}$ , ${}^{cam}T_{obj}$ , ${}^{H}T_{E}$ ) are known, **Write** the equation that determines the necessary motion for the end-effector to get to the object.

من فضلك اقلب الصفحة

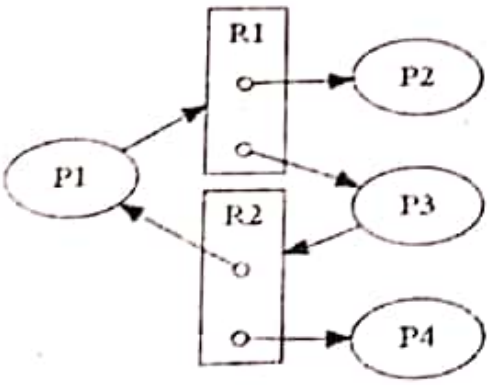


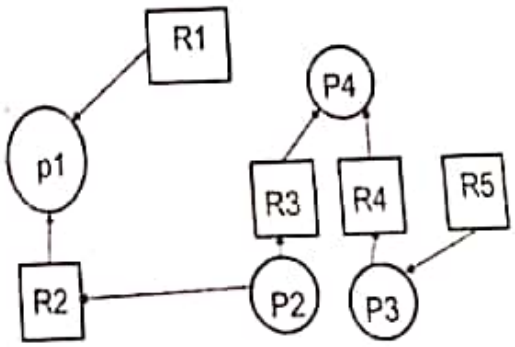
Please Turn Over

a) Show how can three processes execute Synchronize and what are the possible outputs?
b) Define a race condition
c)Are these processes suffer from a race condition? Why?

## Question N0.3 ( 31 marks)

A) Define deadlock and Show the deadlock in the following figures




B) Computer provides the user with virtual address space of $2^{24}$ words. Pages of size 4096
If the hexadecimal virtual address is 123456, what is the page number in binary
C) If there are 64 frames, and the frame size is 1024 words, what is the length of physical address
D) Different between best fit and worst fit by using an example
E) What is meant by kernel? Explain three types of it
F) What is meant by Virtualization?
G) What is meant by Modules? Why OS used it? Explain by figure any one operating system use it
H) Compare between Page table and page map table
I) Why process associate with Process control Block and explain all information of it?

نياتي لكم بالتوفق والنجاح

**Q1) Identify the choice that best completes the statement or answers the question:**

I. Ceramics are generally
   a. brittle and difficult to shear plastically
   b. brittle and easy to shear plastically
   c. flexible and difficult to shear plastically
   d. none of the above

II. Ceramics have
   a. low melting temperatures and low conductivity of electricity
   b. high melting temperatures and low conductivity of electricity
   c. low melting temperatures and high conductivity of electricity
   d. none of the above

III. Polycrystalline alumina
   a. have strength that depends upon porosity and grain size
   b. is a quite hard material accompanied by low friction and wear
   c. can be used as joint replacement material in spite of its brittleness
   d. All the above

IV. Which of the following is considered a major component of corrosion resistant stainless steel?
   a. Lithium
   b. Chloride agent
   c. Magnesium
   d. Chromium

V. The minimal let-go current happens at:
   a. Frequencies above 1 kHz.
   b. Very low frequency.
   c. The frequency of commercial power-line, 50-60Hz.
   d. Exactly DC.

VI. Which of the following is considered False for electrical shock of human body?
   a. The longer the duration, the smaller the current at which ventricular fibrillation occurs
   b. Fibrillation threshold increases with body weight
   c. Fibrillation threshold decreases with body weight
   d. Shock must occur long enough to coincide with the most vulnerable period occurring during the T wave

VII. Preamendment medical devices are:
   a. Devices on the market before May 1976, when the Medical Device Amendments were enacted.
   b. Devices on the market after May 1976
   c. Unapproved devices undergoing clinical investigation
   d. None of the above

VIII. Substantially equivalent medical devices are:
   a. assigned to the same class as their preamendment counterparts and subject to the same requirements
   b. automatically placed in Class III.
   c. exempt from premarketing testing and performance standards but are subject to general controls
   d. All the above.

Please Turn over

| Network type | Node degree, $d$ | Network diameter | No. of links, $l$ | Bisection width, $B$ | Symmetry |
|---|---|---|---|---|---|
| Linear Array | 2 | $N-1$ | $N-1$ | 1 | No |
| Ring | 2 | $\lfloor N/2 \rfloor$ | $N$ | 2 | Yes |
| Completely Connected | $N-1$ | 1 | $N(N-1)/2$ | $(N/2)^2$ | Yes |
| Binary Tree | 3 | $2(k-1)$ | $N-1$ | 1 | No |
| Star | $N-1$ | 2 | $N-1$ | $\lfloor N/2 \rfloor$ | No |
| 2D-Mesh | 4 | $2(r-1)$ | $2N-2r$ | $r$ | No |
| Illiac Mesh | 4 | $r-1$ | $2N$ | $2r$ | No |
| 2D-Torus | 4 | $2\lfloor r/2 \rfloor$ | $2N$ | $2r$ | Yes |
| Hypercube | $n$ | $n$ | $nN/2$ | $N/2$ | Yes |
| CCC | 3 | $2k-1+\lfloor k/2 \rfloor$ | $3N/2$ | $N/(2k)$ | Yes |
| $k$-ary $n$-cube | $2n$ | $n\lfloor k/2 \rfloor$ | $nN$ | $2k^{n-1}$ | Yes |

```
      Do 10 I = 1, N
      A(I) = B(I) + C(I)
10    Continue
      Do 20 J = 1, N
      SUM = SUM + A(J)
20    Continue
```

Where N is the data array size. Rewrite the above code in order to execute the program on an M-processor system. If N = 1000, M = 32 and no overhead due to communications:

1- Compute the number of machine cycles of the sequential code
2- Compute the number of machine cycles of the parallel mode
3- Compute The system speedup
4- Compute The system efficiency.

**(3)** **(20 Marks)**

**3-a)** What are the differences between shared-memory and distributed memory interconnection networks? State the network evaluation characteristics in each case.

**3-b)** Suppose we have an application running on a 32-processor multiprocessor, which has a 200 ns time to handle reference to a remote memory. For this application, assume that all the references except those involving communication hit in the local memory hierarchy. Processors are stalled on a remote request, and the processor clock rate is 2 GHz. If the base CPI (assuming that all references hit in the cache) is 0.5, how much faster is the multiprocessor if there is no communication versus if 0.2% of the instructions involve a remote communication reference?

**3-c)**

i) In one form of scaling a set of linear equations, each row of a matrix A is multiplied by the reciprocal of the maximum absolute value of any element in that row. Write a sequential algorithm for this scaling method.

ii) Using high level pseudo code for an SIMD computer, write a vector version of this algorithm.

iii) If the SIMD machine of part (ii) has separate memories for each processing element, show the storage layout required by your solution in part (ii).

**(4)** **(20 Marks)**

**4-a)** Draw a direct interconnection network for a multicomputer with 64 nodes using:

I. three-dimensional torus
II. six-dimensional binary hypercube
III. cube-connected-cycles (CCC)

**4-b)** Answer the following questions for the 3-ary 4-cube network:

1- How many nodes does the network contain?
2- What is the network diameter?
3- What is the bisection bandwidth?
4- What is the node degree?

**4-c)** You are asked to design a direct network for a multicomputer with 256 nodes using a three-dimensional torus, a six-dimensional binary hypercube, and cube-connected-cycles (CCC) with a minimum diameter. Let d be the node degree, D the network diameter, and I the total number of links in a network. Suppose the quality of a network is measured by $(d \times D \times I)^{-1}$. Rank the three architectures according to this quality measure.

**Note: you can use the following table for reference of question 4:**

## Answer all the following questions (13 Marks)

### First Question: (3 Marks)

a) What are the three applications of VHDL?

b) How is **CLB of Slice M** differ from **CLB of Slice L** in how using LUT (lookup table) in FPGA? (4 Marks)

(Hint: CLB is the abbreviation of **Configurable Logic Block**).

c) Convert the following combinational equations into PAL-based and PLA-based circuits (6 Marks)

(Hint: implement all three equations in only one figure for each PAL or PLA circuit).

$$F1 = a \cdot b \cdot c + b' \cdot c' + a' \cdot c$$

$$F2 = a' \cdot b' + b' \cdot c' + a \cdot b' \cdot c$$

$$F3 = a \oplus c$$

### Second Question: (14 Marks)

a) Compare between combinational and sequential Logic concepts. Support your answer with figures (4 Marks)

b) **What is** the problem within the VHDL code in **figure 1**? **Rewrite** the VHDL code after correcting it, and **finally**, calculate the number of registers that can be inferred from your corrected VHDL code. Also, state the operation that this code will perform after correcting it. (5 Marks)

c) Write a Concurrent VHDL code that implements D-type flip-flop (DFF) with synchronous reset as shown in **figure 2**. (5 Marks)

### Third Question: (14 Marks)

a) State the differences between SIGNAL and VARIABLE. (4 Marks)

b) What is the main difference between CASE statement in Sequential code and WHEN statement in concurrent code (3 Marks)

c) Write a VHDL Sequential Code that implements 4x1 Multiplexer. The four inputs of this multiplexer are **A, B, C, D** and output is **Y**. **S0** and **S1** are selection inputs of this multiplexer. All of these inputs and outputs are **STD_LOGIC** data type. You should use an intermediate variable called "**Sel**" which should be of type **integer** as a representation of **S0 and S1 selection inputs** in VHDL code. use **CASE** statement with this code. **Draw the diagram of the Entity of this circuit.** (7 Marks)

## Answer all the following questions:

### Question N0.1 ( 7 marks )

A) Choose the best answer for each of the following

1- In an operating system a utility which reads commands from a terminal is called:
(A) Terminal Handler (B) Kernel (C) Shell (D) None of them

2- Which is not able to solve the race condition?
(A) Test and Set Lock (B) Shared memory (C) Semaphore (D) Monitor

3- Which is not a CPU scheduling criterion?
(A) CPU utilization (B) Throughput (C) Waiting time (D) Burst time (E ) none of them

4- Which is a preemptive scheduling?
(A) SJF (B) FCFS (C) RR (D) None of them

5-Which is not the necessary condition of a deadlock?
(A) Mutual exclusion (B) Hold and wait (C) Preemption (D) None of them

6- Which one of the following is the deadlock avoidance algorithm?
a) banker's algorithm b) round-robin algorithm c) elevator algorithm d) kern's algorithm
(e)None of them

B) (1) What is a process? Describe the process state.
(2) What is a thread? Give four benefits of using threads

### Question N0.2 ( 22 marks )

MENOUFIA UNIVERSITY
Faculty of Electronic Engineering
Department of Computer Science & Eng.
2nd Semester Final Exam 2017/2018
Date: Sunday 3/6/2018, 10am – 1pm

Subject: Parallel Processing
Code: CSE 321
Year: Third year
Max. Degree: 70 Marks
No. of exam pages: 3

*Answer as much as you can.*

**(1)** **(18 Marks)**

**1-a) Comment on the following statements:**

i. Uni-processor performance improvement via various implicit and explicit parallelism schemes and technology improvements has reached a point of no return.
ii. NUMA architecture is not a natural parallel programming/algorithm model.
iii. The Fork/Join Framework is used for parallel programming in Java, which utilizes the multicore processors.

**1-b) (True/False)**

1- Obtaining more computing power by stamping multiple processors on a single chip (MPSoC) rather than straining to increase the speed of a single processor.
2- Amdahl's law studies how the behaviour of a scaled program varies when adding more computing power.
3- The number of programs a system can execute per unit time, called the system efficiency.
4- In an MIMD computer, all processors must execute the same instruction at the same time synchronously.
5- In shared-memory multiprocessors, interprocessor communication is done in the memory interface by data transmission send and receive procedures.
6- In distributed-memory with message-passing, programming paradigm by read and write instructions

**1-c) Fill in the spaces below:**

1- If the efficiency is kept fixed while increasing at the same rate the problem size and the number of processes is called .....
2- The number of programs a system can execute per unit time, called the system .....
3- For each time period, the number of processors used to execute a program is defined as the .....
4- Advanced Vector Extensions 2 (AVX2) are extensions to ..... introduced by Intel 2015.
5- The number of nodes in the graph is called .....
6- A shared-memory program is a collection of .....

**(18 Marks)**

**(2)**

**2-a) Multiple choice:**

1- Suppose you want to achieve a speedup of 80 with 100 processors, according to Amdahl's law, the fraction of the original computation that can be sequential is approximately:
A- 0.25% B- 0.4% C- 0.5% D- others

2- The bisection width of a ring is
A- 2 B- 4 C- others

3- According to Sun and Ni law the speedup of a system with 8 processors and G(n) = n, if the sequential portion of the program 40% is:
A- 2 B- 4 C- 10 D- others

**2-b)**

1. Under Amdahl's law in the multi-core era, what is the speedup of a symmetric multicore chip for f=0.95, using 8 cores of cost 8 BCEs each?
2. Under Amdahl's law in the multi-core era, what is the speedup of an asymmetric multicore chips for f = 0.97 and 2-cores of 256 BCEs and 512 single-BCE cores?
3. Under Amdahl's law in the multi-core era, what is the speedup of a dynamic multicore chip for f = 0.98 and n = 256

**2-c)** Consider the following code is to be executed in a uni-processor system:

1-off-

## Fourth Question: (19 Marks)

a) Consider the circuit in **figure 3**. It has two inputs **"d"** and **"clk"** and it has two outputs **"q"** and **"qbar"** where **qbar equals "not q"**. **Write only two Architecture codes**. The first code should be written to generate **two registers (i.e. F.Fs)**. the second code should written to generate only **one register (i.e. F.F) and one logic gate "NOT"**. Discuss your two Architecture codes **(6 Marks)**

b) Write a VHDL sequential code that implements the circuit in **figure 4** which represents a 4-bit shift register with **asynchronous reset "rst"**. When **"rst = 1"**, shift register does not work, otherwise, it does its functionality by making **q equal data of first flip-flip**. Use **Generic** statement to make your code general for any n-bit shift register. **(6 Marks)**

c) Write a VHDL code to implement a **Parity Detector** as shown in **figure 5**. The input vector has 16 bits. The output must be '1' when the number of 1's in the input vector is even, otherwise, the output should be '0'. Write a sequential code for this parity detector and by using **FOR ..... LOOP** statement. **(7 Marks)**

```
ENTITY counter IS
   PORT ( clk : IN      STD_LOGIC;
          digit : OUT   INTEGER   RANGE 0 TO 9);
END counter;
ARCHITECTURE counter OF counter IS
BEGIN
   count: PROCESS ( clk )
      BEGIN
         IF ( clk'EVENT AND clk = '1') THEN
            digit := digit + 1;
            IF (digit = 10) THEN digit := 0;
            END IF;
         END IF
      END PROCESS count;
END counter;
```

**Figure 1**

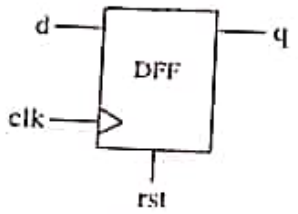



**Figure 2**

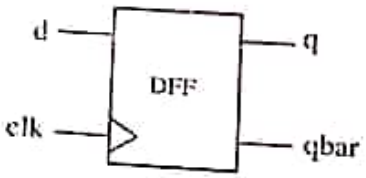



**Figure 3**


**Figure 5**

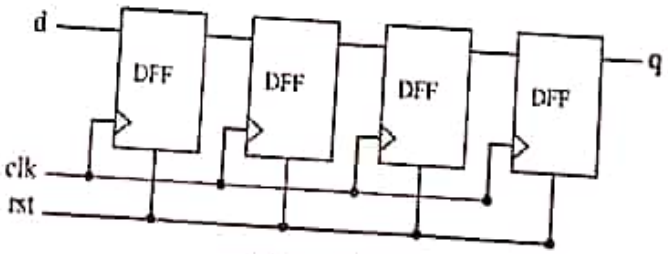



**Figure 4**

(with my best wishes Dr. Mokhtar A. A. Mohamed)

ثالثة إتصالات

| | | |
|---|---|---|
| University: Menoufia<br>Faculty: Electronic Engineering<br>Department: Industrial Electronics and Control Engineering<br>Academic level: 3rd Year<br>Course Name: Control Systems Applications (2)<br>Course Code: ACE 325<br>Academic Year: 2017/2018 | | Date: 23/05/2018<br>Time: 3 Hours<br>No. of pages: 4<br>No. of Questions: 4<br>Full Mark: 60 Marks<br>Exam: Final Exam<br>Examiner: Dr. Tarek Ahmed Mahmoud |

## Answer the following questions

### Question 1
### [15 marks]

Decide which of these statements is true (T) or false (F). Correct the false statement.

1- The term PLC stands for Personal logic computer ( )

2- A transistor output channel from a PLC is not isolated from the output load by an optocoupler. ( )

3- A triac output channel from a PLC is used for only AC output loads. ( )

4- A triac output channel from a PLC is not isolated from the output load by an optocoupler. ( )

5- The reason for including optocouplers on input/output units is to provide a fuse mechanism that breaks the circuit if high voltages or currents occur. ( )

6- The only reset condition of the pulse timer is when its current value equals the preset value. ( )

7- In one application, we can use unlimited number of timers. ( )

8- When the PLC is stopped it can read the inputs. ( )

9- When the reset input (R) of a drum controller is at state 1, the drum controller returns to step one. ( )

10- If the up input (U) of a drum controller is at state 1, it causes the drum advance by one step and updates the control bits. ( )

11- A register function block Is a memory block which is used to store up to 8 words of 16 bits in FIFO way. ( )

12- If the input of a register % Ri denoted by I is at state one , it stores the contents of word %RI.I in the register. ( )

13- The bit %Ri.E of a register %RI indicates that the register is enabled. ( )

14- The word %QW2.0 In the base PLC is associated with the output word %IW0.0 In the peer PLC #2. ( )

15- The word %QW0.0 In the peer PLC #3 is associated with the Input word %IW4.0 in the base PLC. ( )

*Ericsson*: channel bandwidth = 2 × 30 kHz, CIR = 12 dB.

*AlCatel*: channel bandwidth = 2× 20 kHz, CIR = 15 dB.

The user's density in the area to be served is 100 users/km$^2$, 50% of the users are residential of call rate 0.5 call/h/user and the rest are business users of 1call/h/user. The coverage area to be served is 50 km$^2$ and the budget of the project allows only 25 BSs to be built. The allowed blocking probability is 2%. Your report should include the following:

a- The cell radius,

b- The required channels per cell and the channel utilization.

c- Which constructor you have to choose in order to satisfy your requirements?

d- If each cluster has its own MSC, how many MSCs are required?

e- The network capacity and its spectral efficiency.

"Hint: You can use the associated Erlang-B table"

## Erlang B Traffic Table

Maximum Offered Load Versus B and N

| N/B | B is in % 0.01 | 0.05 | 0.1 | 0.5 | 1.0 | 2 | 5 | 10 | 15 | 20 | 30 | 40 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | .0001 | .0005 | .0010 | .0050 | .0101 | .0204 | .0526 | .1111 | .1765 | .2500 | .4286 | .6667 |
| 2 | .0142 | .0321 | .0458 | .1054 | .1526 | .2235 | .3813 | .5954 | .7962 | 1.000 | 1.449 | 2.000 |
| 3 | .0868 | .1517 | .1938 | .3490 | .4555 | .6022 | .8994 | 1.271 | 1.603 | 1.930 | 2.633 | 3.480 |
| 4 | .2347 | .3624 | .4393 | .7012 | .8694 | 1.092 | 1.525 | 2.045 | 2.501 | 2.945 | 3.891 | 5.021 |
| 5 | .4520 | .6486 | .7621 | 1.132 | 1.361 | 1.657 | 2.219 | 2.881 | 3.454 | 4.010 | 5.189 | 6.596 |
| 6 | .7282 | .9957 | 1.146 | 1.622 | 1.909 | 2.276 | 2.960 | 3.758 | 4.445 | 5.109 | 6.514 | 8.191 |
| 7 | 1.054 | 1.392 | 1.579 | 2.158 | 2.501 | 2.935 | 3.738 | 4.666 | 5.461 | 6.230 | 7.856 | 9.800 |
| 8 | 1.422 | 1.830 | 2.051 | 2.730 | 3.128 | 3.627 | 4.543 | 5.597 | 6.498 | 7.369 | 9.213 | 11.42 |
| 9 | 1.826 | 2.302 | 2.558 | 3.333 | 3.783 | 4.345 | 5.370 | 6.546 | 7.551 | 8.522 | 10.58 | 13.05 |
| 10 | 2.260 | 2.803 | 3.092 | 3.961 | 4.461 | 5.084 | 6.216 | 7.511 | 8.616 | 9.685 | 11.95 | 14.68 |
| 11 | 2.722 | 3.329 | 3.651 | 4.610 | 5.160 | 5.842 | 7.076 | 8.487 | 9.691 | 10.86 | 13.33 | 16.31 |
| 12 | 3.207 | 3.878 | 4.231 | 5.279 | 5.876 | 6.615 | 7.950 | 9.474 | 10.78 | 12.04 | 14.72 | 17.95 |
| 13 | 3.713 | 4.447 | 4.831 | 5.964 | 6.607 | 7.402 | 8.835 | 10.47 | 11.87 | 13.22 | 16.11 | 19.60 |
| 14 | 4.239 | 5.032 | 5.446 | 6.663 | 7.352 | 8.200 | 9.730 | 11.47 | 12.97 | 14.41 | 17.50 | 21.24 |
| 15 | 4.731 | 5.634 | 6.077 | 7.376 | 8.108 | 9.010 | 10.63 | 12.48 | 14.07 | 15.61 | 18.90 | 22.89 |
| 16 | 5.339 | 6.250 | 6.722 | 8.100 | 8.875 | 9.828 | 11.54 | 13.50 | 15.18 | 16.81 | 20.30 | 24.54 |
| 17 | 5.911 | 6.878 | 7.378 | 8.834 | 9.652 | 10.66 | 12.46 | 14.52 | 16.29 | 18.01 | 21.70 | 26.19 |
| 18 | 6.496 | 7.519 | 8.046 | 9.578 | 10.44 | 11.49 | 13.39 | 15.55 | 17.41 | 19.22 | 23.10 | 27.84 |
| 19 | 7.093 | 8.170 | 8.724 | 10.33 | 11.23 | 12.33 | 14.32 | 16.58 | 18.53 | 20.42 | 24.51 | 29.50 |
| 20 | 7.701 | 8.831 | 9.412 | 11.09 | 12.03 | 13.18 | 15.25 | 17.61 | 19.65 | 21.64 | 25.92 | 31.15 |
| 21 | 8.319 | 9.501 | 10.11 | 11.86 | 12.84 | 14.04 | 16.19 | 18.65 | 20.77 | 22.85 | 27.33 | 32.81 |
| 22 | 8.946 | 10.18 | 10.81 | 12.64 | 13.65 | 14.90 | 17.13 | 19.69 | 21.90 | 24.06 | 28.74 | 34.46 |
| 23 | 9.583 | 10.87 | 11.52 | 13.42 | 14.47 | 15.76 | 18.08 | 20.74 | 23.03 | 25.28 | 30.15 | 36.12 |
| 24 | 10.23 | 11.56 | 12.24 | 14.20 | 15.30 | 16.63 | 19.03 | 21.78 | 24.16 | 26.50 | 31.56 | 37.78 |
| 25 | 10.88 | 12.26 | 12.97 | 15.00 | 16.13 | 17.51 | 19.99 | 22.83 | 25.30 | 27.72 | 32.97 | 39.44 |
| 26 | 11.54 | 12.97 | 13.70 | 15.80 | 16.96 | 18.38 | 20.94 | 23.89 | 26.43 | 28.94 | 34.39 | 41.10 |
| 27 | 12.21 | 13.69 | 14.44 | 16.60 | 17.80 | 19.27 | 21.90 | 24.94 | 27.57 | 30.16 | 35.80 | 42.76 |
| 28 | 12.88 | 14.41 | 15.18 | 17.41 | 18.64 | 20.15 | 22.87 | 26.00 | 28.71 | 31.39 | 37.21 | 44.41 |
| 29 | 13.56 | 15.13 | 15.93 | 18.22 | 19.49 | 21.04 | 23.83 | 27.05 | 29.85 | 32.61 | 38.63 | 46.07 |
| 30 | 14.25 | 15.86 | 16.68 | 19.03 | 20.34 | 21.93 | 24.80 | 28.11 | 31.00 | 33.84 | 40.05 | 47.74 |

Best wishes

Dr. Saied M. Abd El-atty

*A phase-locked loop (PLL) is an electronic communication system, which synchronizes an internal oscillator, in frequency and phase, with an external signal. According to your understanding this communication circuit. Answer the followings:*

1) **Draw** the block diagram of phased locked loop (PLL). **Derive** the transfer function of PLL using passive low-low pass filter. **Obtain** the magnitude of the steady-state frequency response and **plot** the PLL frequency response for various damping damping factors, $\zeta$ and hence **prove** that, the maximum value of the frequency response $M_P$ is given by **Eq.(1)**. Finally, **obtain** the 3-dB bandwidth $\omega_h$.

$$M_P = \frac{N}{2\zeta\sqrt{1-\zeta^2}} \qquad (1)$$

2) If the above PLL without filter used as a frequency synthesizer to synthesize a **0.1** MHz signal from a **0.5kHz** reference frequency. Determine the bandwidth of that synthesizer, when the typical value for $K_d$ is **0.5 V/rad**, and a typical value for the VCO gain factor $K_o$ (for a **0.1-MHz** VCO) is **1 kHz/V**. What value of low-pass filter should be used so that the closed-loop system approximates a second-order Butterworth filter? Compute the new bandwidth, the corresponding system rise time and hold in range (lock range).
3) What is the benefit to use multiple-loop synthesizer instead of single frequency synthesizer? Explain by illustrating the block diagram.
4) Describe a digital circuit used in PLL to perform phase detector and phase-frequency detector.
5) Define the frequency synthesizer; construct a direct frequency synthesizer (DFS) with mix-divide module and then design a DFS with three-frequency resolution based on mix-divide module. If the output of the third module is taken before the decade divider. How can you obtain a frequency of **18.64MHz** when $f_{in}$=1MHz?

**Question 2** **(15 M)**

**Question No. (5):**

**A.** A DC motor is used in a robot manipulator. It is desired to have this DC motor to go from initial angle of 30° to a final angle of 75° in 5 s. It is assumed that the robot starts from rest and stops at its destination. **[30 Marks]**

- ☐ Using a third order polynomial, calculate the desired joint's angle, velocity, and acceleration. **(8 Marks)**

**B. For the connected gears mechanism shown in figure-1:** **(10 Marks)**

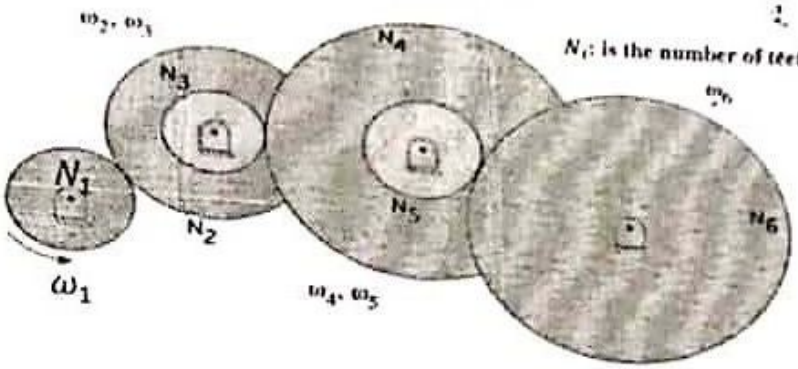
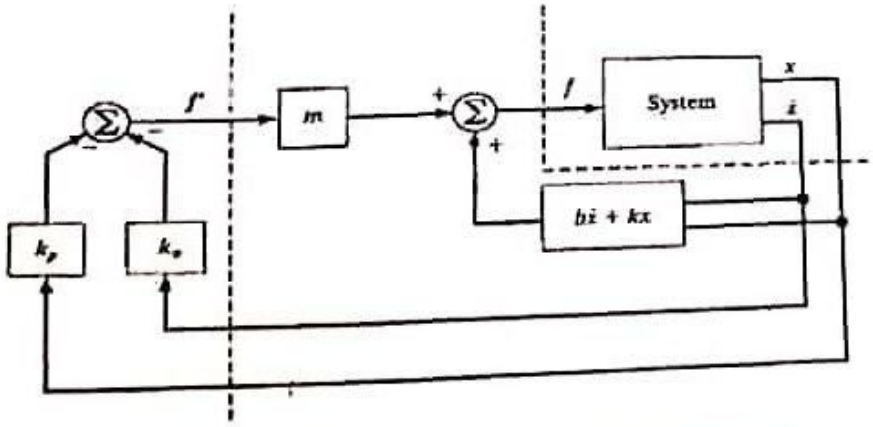



**Figure-1**

1. What is the name of this mechanism?
2. What is the function of such mechanism?
3. Determine the direction of rotation of gear 2 and gear 6 in this mechanism if driver direction is as shown in the figure?
4. Derive (**Don't write it directly**) a relation for the total gear ratio that relates the driver to driven.

**C. For the system shown in Figure-2:** **(12 Marks)**

1. In what case we use the controllers shown in the below block diagram?
2. Write down the control law equation for the controller that will reduces the system so that it appears to be a unit mass? Give the name of that controller?
3. Write down the control law equation for the controller that will modify the behavior of the system. Give the name of that controller?
4. Write the open-loop dynamics equation of a system to be controlled?



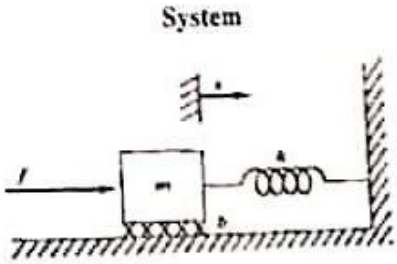




**Figure-2**

*End of Questions*

**With our Best Wishes**

**Dr. Tarek Y. Khedr - Dr. Osama Elshazly**

**Q.2.** **(15 Marks)**

a. Derive the optimality conditions for a multivariable unconstrained problem
b. Find the local minimum points for the following functions:
   i. $f(x) = \sin x$
   ii. $f(x_1, x_2) = 4x_1^2 + 2x_1x_2 + x_2^2 + 6$

**Q.3.** **(20 Marks)**

a. Use the lagrange multiplier theorem to derive the first order necessary conditions for equality constraints.
b. What is the geometrical meaning of the Lagrange multipliers?
c. Minimize $f(x_1, x_2) = 2x_1^2 + 4x_2^2 + x_1 - x_2 + 7$.
   Subject to $x_1 - x_2 + 3 = 0$
d. Maximize $f(x_1, x_2) = 5x_1^2 + 2x_2^2 - 3x_1x_2 - 10$
   Subject to $x_1 + x_2 \leq 2$

**Q.4.** **(15 Marks)**

**A system is described by the following state equations:**

$$\dot{x}_1(t) = 3x_2(t)$$

$$\dot{x}_2(t) = 2u(t)$$

with the boundary conditions $x(0) = [1\ 0]^T; x(3) = [2\ 3]^T$.

Design an optimal control that minimize the cost function:

$$J = \int_0^3 u^2(t)dt$$

by using the following methods:

a. Euler-Lagrange multiplier theorem.
b. Maximum principle.

**GOOD LUCK**

**Answer the following questions:**

***Question 1:*** **(Answer two points only)** **(10 Marks)**

a- Explain the steps of feature extraction from speech signals for efficient speaker identification. Sketch the frequency response of the Mel filter bank used. If this Mel filter bank is inverted, which means that the last filter comes first and first filter comes last, what is the effect of this on the speaker identification process?

b- Derive an expression for the adaptive Wiener filter utilized for speech enhancement. What is the difference between this filter and the adaptive least mean square noise canceller?

c- Explain the steps of a speech encryption algorithm. Can we perform speech encryption by merging the speech signal with random noise having large variance? If possible, what do you expect as the limitations of this trend?

***Question 2:*** **(Answer two points only)** **(10 Marks)**

a- Explain the steps of SVD audio watermarking? Why is the SVD used for audio watermarking? Is it possible to separate the watermark from the audio signal through a simple filtering technique? Why?

b- What is the difference between audio watermarking on the signal as a whole and audio watermarking on a segment by

to reduce the size of the image to one fourth the original size as a tool for image compression, and hence we can perform interpolation to recover the original image size as a tool for decompression. Is this scenario applicable for speech signals? Why?

b- What is meant by the energy compaction property of DCT? Explain how this property can be utilized in speaker identification systems. Can we use complex transforms such as the DFT instead of the DCT for feature extraction? Why?

c- What is the rule of the pre-whitening process utilized in adaptive filters implemented on speech signals? Can the pre-whitening filter be a lowpass filter? Why?

***Question 5:*** **(Answer two points only)** **(10 Marks)**

a- Explain the process of adaptive echo cancelation in telephone systems. What is the effect of noise on the adaptive echo cancelation process?

b- Explain the process of speech deconvolution. Can an adaptive equalizer perform this task? Explain how.

c- What are the rules that determine the step size and convergence speed of adaptive lms filters? Is it better to use a single adaptive filter on the speech signal or to use a cascaded structure of adaptive filters? Why?

***Question 6:*** **(Answer two points only)** **(10 Marks)**

a- Explain the process of blind system identification using adaptive filters? Can we use this concept for the identification of the vocal tract impulse response of speakers? Why?

b- Explain how the processes like watermarking, and encryption affect the performance of speaker identification systems? Is it possible to perform speaker identification from encrypted speech signals? Why?

c- The cancelable biometrics concept adopts creating unreal biometrics for persons through some mathematical manipulations to avoid stealing of the original biometrics. Is this applicable on speech signals? Why?

***Question 7:*** **(Answer two points only)** **(10 Marks)**

a- Most speaker identification systems are based on cepstral analysis. Why? Can we perform speaker identification on the signals in time domain? Why?

b- Can we use the silence periods in speech signals for watermarking? Explain how.

c- What is the importance of the polynomial coefficients used for speaker identification? If these polynomial coefficients are dropped, what is the effect of that on the speaker identification process?

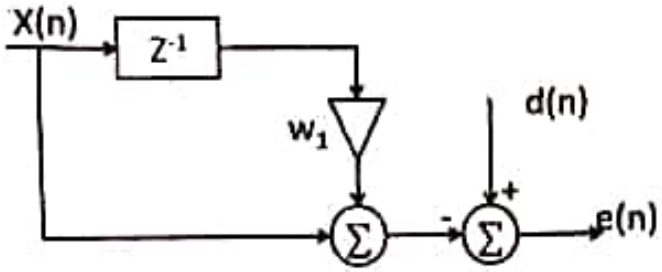
Best Wishes
Fathi E. Abd El-Samie

MENOUFIA UNIVERSITY
FACULTY OF ELECTRONIC ENGINEERING
TRONICS AND COMMUNICATIONS ENGINEERING DEPART
DIGITAL SIGNAL PROCESSING
May 2017 Third Year Final Exam. Period: 3.0 Hrs

**Answer the following questions:**

1- Use the simple low pass filter $H(s) = 1/(s+1)$ and the bilinear transform method to design a digital band - stop filter with cut off frequencies 3 and 5 KHz. The sampling frequency is 15KHz. (12)

2- Draw the block diagram of a digital adaptive filter. (6)
For the adaptive filter shown, find the performance function $E[e^2(n)]$. (6)




3- Design a low pass FIR filter with cut off frequency 2 KHz. The sampling frequency is 12 KHz. The impulse response is limited to 0.8 msec. (12)

4. An FIR filter with transfer function given by :

$$H(z)= h_0 + h_1 z^{-1} + h_2 z^{-2} + h_3 z^{-3} + h_4 z^{-4}$$

Realize the filter using the polyphase form, then find the transpose of the structure. (12)

5. An IIR filter with transfer function given by :

$$H(z) = z\,(z - 0.3) / (z^2 - 0.1\,z - 0.02)$$

Realize the filter using the cascade form. (12)

توقيع استاذ المادة

**Answer the following questions:**

1- a- Explain, with the aid of a sketch and equations, the calculation of IDT parameters. What is meant by damping an ultrasound transducer, and why is this necessary? What influence does damping have on the frequency response of the transducer? (6Marks)

b- A SAW is generated on the surface of a piezoelectric substrate by mean of an ac voltage applied to an IDT at $f_o$ = 1GHz. Given that the velocity of propagation of the SAW on this material is v = 3488m/s, determine the acoustic wavelength. Compare the value of this wavelength with that of an electromagnetic wave propagating in free space at the same frequency. Determine the ratio between the SAW wavelength and the electromagnetic wavelength in this case. Comment on the obtained results. (8Marks)

2- a- Explain, with the aid of a block-diagram and equations, the overall transfer function of an ideal linear-phase response SAW filter (4Marks)

b- A SAW filter with nominal linear-phase response employs identical uniformly apodized IDTs in input and output stages. Each IDT has N=80 electrodes. Determine (i) the approximate 4-dB percentage fractional bandwidth of each IDT and (ii) their 3-dB fractional bandwidth; (iii) indicate whether or not the overall 4-dB filter bandwidth will be the same as in (i); and (vi) determine the approximate suppression level (in dB) of the first sidelobes of the filter. (10Marks)

3- a- Draw and discuss the input/output equivalent circuit for a Surface Acoustic Wave (SAW) filter in the cross-field model at a center frequency $f_o$. (4Marks)

b- A SAW filter is fabricated on YZ- $LiNbO_3$. Its input and output IDTs have constant finger overlap. The input IDT has $N_p$ = 50 finger pairs and apodization width W = 100 acoustic wavelengths at a center frequency $f_o$ = 400 MHz. Consider that the capacitance/ finger pair/cm is $C_o$ = 4.6 pf/cm. Determine the numerical values of the unperturbed radiation conductance $G_a$ at $f_o$. ( For YZ-$LiNbO_3$: v = 3488m/s and $k^2$ = 4.6 % ). (10Marks)

4- a- Sketch an illustrative transceiver for a digital-cellular communications transceiver, such as for the GSM , and indicate the possible location of constituent SAW components. (4Marks)

b- What are SAW wireless label identification "tags", and what are they used for?. (4Marks)

c- A SAW convolver has a rated convolution efficiency $h_c$ = - 46 dBm. If the signal input power $P_s$ is 10 dBm (10 mW) and the reference power $P_r$ is 20 dBm (100 mW), what is the correlated output power $P_{out}$?. If the output noise floor level in the previous SAW convolver is - 75 dBm, determine the output Signal-to-Noise (S/N) ratio. (6Marks)

5- a- Stat the four types of acoustic sensors. and draw an equivalent circuit model to describe the interaction between a SAW and charge carriers in a film overlay. (4Marks)

b- Deposition of a 100 nm-thick AL film on a $LiNbO_3$ SAW device causes sheet conductivity vary from $\sigma_s << v_o C_s$ to $\sigma_s >> v_o C_s$ . (a) What acoustoelectric velocity and attenuation changes arise from this film? . (b) What is the maximum acoustoelectric attenuation (in dB) for a 100-MHz $LiNbO_3$ device with a path length of 100 $\lambda$?.( For $LiNbO_3$ $k^2$ = 4.8 % ) . (10Marks)

**Answer the following questions:**

Check if the system given by :

$$y(n) = x(n)$$

is time variant or not.

---

2. The input/output equation of a digital filter is given by :

$$y(n) + 2y(n-1) + y(n-2) = x(n) - x(n-1) \qquad 0 \leq n.$$

(a) Find the poles and zeros.

(b) Draw the magnitude and phase responses of the filter.

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Menoufia University
Faculty of Electronic Engineering
Electronics & Electrical Comm. Dept.
For 3rd year, Final Exam (2016/2017)

Acoustics (ECE 313)
Time Allowed: 3 H
17 Jan. 2017
Total marks: 70 marks

**Attempt the following questions:**

**1-a)** Show that the expression $p = A\,e^{j(\omega t - kx)} + B\,e^{j(\omega t + kx)}$ is a solution for the pressure wave equation $\frac{\partial^2 p}{\partial x^2} - \frac{1}{c^2}\frac{\partial^2 p}{\partial t^2} = 0$.

**1-b)** Knowing that the particle velocity $u_x$ is given by $u_x = -\frac{1}{\rho_o}\int \frac{\partial p}{\partial x} dt$, and that the displacement $\xi_x = \int u_x \, dt$, find an expressions for both $u$ and $\xi$ in the $x$-direction and hence draw the phasor diagram for both forward and backward travelling waves.

**1-c)** A plane sound wave propagating in water contains 120 watts of acoustic power distributed uniformly over a circular section of 30 cm diameter. If the frequency of the wave is 50 Hz, determine:

a) The intensity I in watt/m$^2$.
b) The sound pressure amplitude.
c) The particle velocity amplitude.

**Note:**

For water: $\rho_o$=1000 kg/m$^3$ and $c_o$= 1500 m/sec.

**2-a)** The specific acoustic impedance of a spherical wave is given by $Z = \rho_o c_o \frac{kr(kr+j)}{1+k^2r^2}$. For what value of $kr$ is the specific acoustic resistance 10 times of its specific acoustic reactance?

**2-b)** Given a small source of spherical waves in water. For a radial distance of 150 cm, compute the difference in phase angle between pressure and particle velocity at a frequency of 100 kHz. Calculate also the magnitude of the specific acoustic impedance for these conditions.

**4-b)** Sketch and describe the principle of operation of a direct radiator loudspeaker (DRL) stating the main function of the corrugation in the cone.

**4-c)** State at least three factors that must be considered in the design of an ideal loudspeaker.

**4-d)** Define the following terms, giving their units:

i) Transformation factor $\phi$.
ii) Motional impedance $Z_M$.
iii) Blocked impedance.

**4-e)** A DRL has a total mass of 0.02 kg, (voice coil and cone) operating in a magnetic field B= 1 Weber/m$^2$. The radius of the speaker is 0.2 m, its mechanical resistance is 1 kg/sec, its radiation resistance is 2 kg/sec, and the stiffness of the cone is 2000 N/m. The length of the voice coil is 7 m, its inductance is 0.0005 H and its resistance is 12 Ω. Calculate the following quantities at a frequency 175 Hz:

a) The frequency of mechanical resonance $Z_m$.
b) The electroacoustic efficiency η.
c) The acoustic power output produced by a driving voltage of 20 V.

*With my best wishes,*

*Prof. Dr. Aly Hassan*

*Question No 1 :* **( 20 Marks)**

a) Described the necessary four equations to show how the electric and magnetic fields (differential and integral form equations) propagate, interact and how they are influenced by object. **( 10 Marks)**

b) The plane wave propagating in fresh water at frequency $2.5 \times 10^9$ Hz. The real and imaginary part of the permittivity are $\varepsilon' = 78$ and $\varepsilon'' = 7$. Find the attenuation function, phase constant and intrinsic impedance of the fresh water. **( 10 Marks)**

*Question No 2 :* **( 20 Marks)**

a) Begin with one of Maxwell's curl equations to find the power flow associated with electromagnetic wave. **(10 Marks)**

b) If the transmission line with inductance, capacitance and conductance per unit length for an individual line are L, C and G respectively, and the medium with permittivity $\varepsilon$, permeability $\mu$ and conductivity $\sigma$ find the following:

i) The relation between the transmission line and medium parameters.

ii) The procedure to obtain the attenuation and phase constant. **(10 Marks)**

*Question No 3:* **(20 Marks)**

a) Draw the flow diagram chart of Transmission Line Matrix (TLM) program technique to obtain the components electric and magnetic field for the microstrip of Fig. 1, and the write the following:

i) The necessary equations for the total voltage impulse reflected along line n at time $(1+k)\Delta l$.

ii) The scattering matrix equations.

iii) Power and impedance. **(10 Marks)**

b) Drive the general equations for two dimensional transmission line element for the following:

i) General series connected node with permeability stub.

ii) General shunt connected node with permittivity and loss stub.

**(10 Marks)**

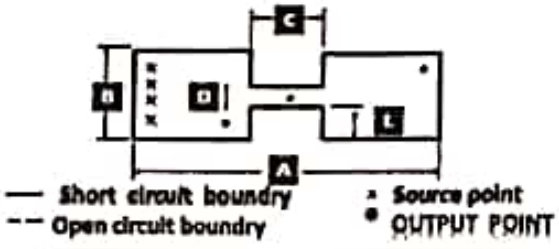



Fig . 1. Two dimensions waveguide.

***Question No 4:*** **(30 Marks)**

a) For the model of the microstrip filter of Fig. 2. Drive the equation to find the following:

i) The propagation velocity $v_p$ , the wavelength of the signal inside the microstrip, free-space wavelength $\lambda_o$ and The phase-constant of the signal.

ii) The inductance and capacitance per length.

iii) Transmission Parameters, Scattering Parameters, Insertion Loss, and Return Loss.

Fig. 2. Model of micrstrip filter. **(10 Marks)**

b) Starting from Maxwell's equations in three dimensions domain to obtain the update equations of the following:

i) Transfer Electric Field in z-direction TEz.

ii) Transfer Magntic Field in z-direction TMz. **(10 Marks)**

c) For the rectangular cavities in three directions is given in Fig.3:

i) Represent the three dimensional matrix using two-dimensional nodes.

ii) Write the necessary equation to support both E-modes and H-modes.

**(10 Marks)**

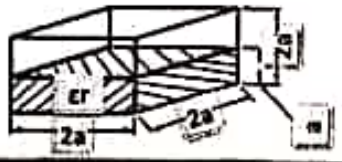



Fig . 3 Rectangular cavity loaded with a lossy dielectric slab.

**Total: 90 Marks**

توقيع أستاذ المادة

أ. د/ عبدالعزيز ابراهيم محمود حسنين

## Answer the following Questions

$Q_1$: Differentiate among Model validation, verification, and calibration. Draw the modeling and simulation cycle, indicating the validation. **(5M)**

$Q_2$: List the network simulation packages, explain three of them. **(5M)**

$Q_3$: What is the memoryless property? Let $x$ be an exponentially distributed with a mean of $(1/\mu)$. Determine the process generator for $x$. Consider a digital a communication network, the transmitter (TX) sends **2** bytes to receiver (RX) in a noisy channel. Calculate the bit error rate, if the bits in position **7, 9** and **12** received in error as shown below. Generate the code implementation by using MATLAB. **(5M)**

$Q_6$: On a network gateway, measurements show that the packets arrive at a mean rate of 100 packets per second (pps) and the gateway takes about 4 milliseconds to forward them. Using an M/M/1 model, analyze the gateway. What is the probability of buffer overflow if the gateway had only 9 buffers? How many buffers do we need to keep packet loss below one packet per million? (6M)

$Q_7$: Consider a **Greek** weather dynamical system is expressed by discrete time Markov chain (DTMC) $\{X(n), n = 1, 2, 3, \cdots\}$ whose state $X(n)$ represents the weather in **Athens** at day $n$. The sequence forms a dynamical system. The weather system can be in one of three states: Sunny, Rainy, or Cloudy. (7M)

Find the following:

a) A state space of the weather system

b) A transition probability matrix

c) A state transition diagram

$Q_8$: List the steps for development of Systems Simulation, discuss three of them. (7M)

$Q_9$: Define SLCM, how it can use and how it can achieve for modeling project (7M)

$Q_{10}$: It is required to design a mobile radio network. The allocated frequency spectrum is 2x530 kHz while the channel bandwidth is 2x25 kHz. The acceptable CIR is 18 dB. If the call duration is 120 sec, determine:

a-The cluster size b- The number of channels per cell.

c- If each cell has 200 users on the average and each user places one call in the busy hour, calculate the expected blocking probability.

d- Determine the cell radius if the user density is 0.636 users/km$^2$. e- The reuse distance (8M)

1] a) Define the relative refractive index difference for an optical fiber and show how it may be related to the numerical aperture . [2 Marks]

b) Briefly indicate with the aid of suitable diagrams the difference between meridional and skew ray paths in step index fibers. [2 Marks]

c) Explain what is meant by a graded index optical fiber, giving an expression for the possible refractive index profile? Using simple ray theory concepts, discuss the transmission of light through the fiber. Indicate the major advantage of this type of fiber with regard to multimode propagation. [3 Marks]

2] a) Describe the phenomenon of modal noise in optical fibers and suggest how it may be avoided.[3 Marks]

b) Briefly explain the reasons for pulse broadening due to material dispersion in optical fibers.

The group delay $\tau_g$ in an optical fiber is given by:

$$\tau_g = \frac{1}{c}\left(n_1 - \frac{\lambda\, dn_1}{d\lambda}\right)$$

where c is the velocity of light in a vacuum, $n_1$ is the core refractive index and $\lambda$ is the wavelength of the transmitted light. Derive an expression for the rms pulse broadening due to material dispersion in an optical fiber and define the material dispersion parameter. [5 Marks]

c) The material dispersion parameter for a glass fiber is 20ps/nmkm at a wavelength of 1.5μm. Estimate the pulse broadening due to material dispersion within the fiber when light is launched from an injection laser source with a peak wavelength of 1.5 μm and an rms spectral width of 2nm into a 30km length of the fiber. [5 Marks]

| | | | | | |
|---|---|---|---|---|---|
| *University* | : | Menoufia | | *Date* | : 24/05/2017 |
| *Faculty* | : | Electronic Engineering | | *Time* | : 3.0 Hours |
| *Department* | : | Electronic and Electrical Communication | | *No. of pages* | : 1 page |
| *Academic level* | : | Third Year | | *Full Mark* | : 60 Marks |
| *Course Name* | : | Mobile Comm. Systems | | *Exam* | : Final Exam |
| | | | | *Examiner* | : Prof. Mona Shokair |

**Answer all the following Questions :**

***Question No 1 :*** **(20 Marks)**

a) Draw the block diagram of transmitter of GSM system and explain each stage? ( 10 Marks)
b) Calculate the wavelength, number of channels and duplex distance of GSM 1900 where Uplink frequencies (1850-1910 MHz) and Down link frequencies (1930-1990 MHz)? (5 Marks)
c) Explain PRMA protocol? ( 5 Marks)

***Question No 2:*** **(20 Marks)**

a) From your opinion, what are the constrictions of primary and secondary system in CRN? ( 10 Marks)
b) What are the main applications of CRN? ( 5 Marks)
c) What are the challenges of sensing techniques in CRN? ( 5 Marks)

***Question No 3 :*** **( 20 Marks)**

a) Draw the block diagram of OFDM system and explain each stage by describing the benefit of each block? (10 Marks)
b) Explain how can calculate the optimum weights using Wiener Solution? (5 Marks)
c) What is the main difference between diversity and AAA techniques? (5 Marks)

*Best Regards*

*Prof. Mona Shokair*

**Midterm Exam:** **Digital Image Processing**

**Time Allowed** **1 hour**

**Answer five questions only:** **(4 Marks for each point)**

1- Explain the process of super-resolution reconstruction of images.
2- Compare between the different image restoration methods.
3- What is the difference between low pass and median filtering of images? Write Matlab codes for both of them.
4- What are the types of blur encountered in digital images? Explain a blur identification method for degraded images.
5- Explain the idea of adaptive image interpolation.
6- What are the limitations encountered in the image restoration process? Show how we can eliminate them.
7- Explain the filter implementation process in images. Explain the effect of filter size on both low pass, high pass, and median filters on images.
8- Show how may the image sub-sampling process cause degradations in images?

*Best wishes.*

terms: plaintext, encryption algorithm, secret key, ciphertext and dec
?
(2 n

Symmetric Encryption Model and what are requirements for high se
(2 n

es of attacks on encrypted messages?
(2 n

: input value {21}, what is substitute byte transformation?

ative inverse in GF($2^8$).

| | y | |
|---|---|---|
| 1 | 2 | 3 |
| 01 | 8D | F6 |
| B4 | AA | 4B |
| 6E | 5A | F1 |
| 45 | 92 | 6C |
| FE | 37 | 67 |

Transformation matrix

$$\begin{bmatrix} b_0' \\ b_1' \\ b_2' \\ b_3' \\ b_4' \\ b_5' \\ b_6' \\ b_7' \end{bmatrix} = \begin{bmatrix} 1 & 0 & 0 & 0 & 1 & 1 & 1 & 1 \\ 1 & 1 & 0 & 0 & 0 & 1 & 1 & 1 \\ 1 & 1 & 1 & 0 & 0 & 0 & 1 & 1 \\ 1 & 1 & 1 & 1 & 0 & 0 & 0 & 1 \\ 1 & 1 & 1 & 1 & 1 & 0 & 0 & 0 \\ 0 & 1 & 1 & 1 & 1 & 1 & 0 & 0 \\ 0 & 0 & 1 & 1 & 1 & 1 & 1 & 0 \\ 0 & 0 & 0 & 1 & 1 & 1 & 1 & 1 \end{bmatrix} \begin{bmatrix} b_0 \\ b_1 \\ b_2 \\ b_3 \\ b_4 \\ b_5 \\ b_6 \\ b_7 \end{bmatrix}$$

(4 n

ibe the AES key expansion algorithm?
(3 n

Playfair matrix, encrypt the message using the two matrixes and c

**Must see you over Cadogan West. Coming at once.**

| | | | |
|---|---|---|---|
| F | H | I/J | K |
| N | O | P | Q |
| V | W | X | Y |
| L | A | R | G |
| S | T | B | C |

| | | | | |
|---|---|---|---|---|
| L | A | R | G | E |
| S | T | B | C | D |
| F | H | I/J | K | M |
| N | O | P | Q | U |
| V | W | X | Y | Z |

(4 mn

# EMC

*Answer the following questions:*

## Question (1) (12 Marks)

1) What is the effect of a spark gap? Explain the mechanism of this effect?

[2 Marks]

2) Name a source of unintended electromagnetic wide frequency band emission and another that produces narrow frequency band emission.

[2 Marks]

3) Why computers and similar digital devices are considered to be a source of electromagnetic emissions?

[2 Marks]

4) When would an electronic system be considered electromagnetically compatible with its environment?

[2 Marks]

5) What are the main aspects of concern in electromagnetic compatibility?

[2 Marks]

6) When does the unintentional transfer of electromagnetic energy cause interference?

[2 Marks]

## Question (2) (16 Marks)

1) What is the purpose of the power supply in an electronic system?

[2 Marks]

2) What is the difference in effect, with respect to electromagnetic compatibility, between using metallic and using non-metallic enclosures for electronic systems?

[2 Marks]

3) Would the 50 Hz current flowing through the power cord to the electronic equipment be of concern for the electromagnetic compatibility problems or it is the cord itself or something else, and why?

[2 Marks]

4) What is radiated susceptibility?

[2 Marks]

5) An aeroplane is flying at a speed of 1000 Km per hour, find its speed expressed in centimeters per second.

[4 Marks]

6) A twin-wire transmission line of length 25 meters is carrying a signal from an antenna to a television receiver set at a frequency of 500 MHz, determine its electrical length.

[4 Marks]

## Question (3) (12 Marks)

1) What is the importance of electrostatic discharge in electromagnetic compatibility?

[2 Marks]

2) What is lightning, and how it produces the resulting sound?

[2 Marks]

3) Explain what is meant by TEMPEST?

[2 Marks]

4) What is the importance of the mathematical model for a phenomenon?

[2 Marks]

5) What are the reasons behind the fact that nowadays almost all the electronic functions were being implemented digitally?

[2 Marks]

6) Name two bodies that are responsible for producing the regulations for the standards of the limits of electromagnetic emissions.

[2 Marks]

## Question (4) (12 Marks)

1) Give one example for the effects of interference on electronic devices or equipment.

[2 Marks]

2) What are the reasons for the EMC requirements that manufacturers voluntarily impose on their products?

[2 Marks]

3) What is the range of frequencies that is decided to be RF frequencies in the USA?

[2 Marks]

4) What are the purposes of the electromagnetic compatibility regulations?

[2 Marks]

5) What is class A and class B of digital devices?

[2 Marks]

6) What does one mean by more stringent class in electromagnetic compatibility? What is the more stringent class, and why?

[2 Marks]

## Question (5) (18 Marks)

1) Are personal computers belongs to class A or class B and why?

[2 Marks]

2) What is the frequency range for conducted emissions?
What is the frequency range for radiated emissions?

[2 Marks]

3) Draw the circuit of the line impedance stabilization network (LISN) and explain the purpose of each element in the circuit.

[5 Marks]

4) Draw a sketch for a semianechoic chamber, and explain its components and the required distances?

[5 Marks]

5) What are the marks that one will find on the equipment that indicate the compliance of the equipment to the USA regulations and to the European regulations?

[2 Marks]

6) What is the near-field-far-field boundary at 15 MHz and at 3 GHz?

[2 Marks]

(Good Luck)

| | | | | | |
|---|---|---|---|---|---|
| *University* | : | *Menoufia* | | *Date* | : *14/1/2017* |
| *Faculty* | : | *Electronic Engineering* | | *Time* | : *3 Hours* |
| *Department* | : | *Electronics and Electrical Communications* | | *No. of pages* | : *3* |
| *Academic level* | : | *BSc, Third Year* | | *Full Mark* | : *70 Marks* |
| *Course Name* | : | *Elective Course 2 (Digital Image Processing)* | | *Exam* | : *Final Exam* |
| *Course Code* | : | *EEC 316* | | *Examiner* | : *Dr. Fathi Abd El-Samie* |

**Answer the following questions:**

***Question 1:*** **(Answer two points only)** **(5 Marks for each point)**

a- Suggest applications for image processing in the fields of medicine, sport, astronomy, and agriculture.

b- Suppose you were to scan a monochromatic image, and then print out the result. Then suppose you scanned in the printout, and printed out the result of that, and repeated this a few times. Would you expect any degradation of the image during this process? Why? Suggest solutions if there are degradations.

c- Explain the histogram equalization process. Assume, we applied histogram equalization on an image twice, does it differ from applying it once? Why?

***Question 2:*** **(Answer two points only)** **(5 Marks for each point)**

a- Compare between low-pass, high-pass, and median filters used for image processing. Write Matlab codes for each of them.

b- Explain the idea of homomorphic image enhancement. Write a Matlab code for homomorphic image enhancement.

c- Explain the idea of image compression using neural networks.

***Question 3:*** **(Answer two points only)** **(5 Marks for each point)**

a- State the different types of blur and explain a blur identification method. Can we use logarithmic processing in image restoration like that in homomorphic processing? Why?

b- Explain the steps of JPEG compression. What is the difference between JPEG and MPEG compression? Why do we use the discrete cosine transform for image compression? Can we use the Fourier transform instead? Why?

c- What is meant by image interpolation? Explain the idea of polynomial image interpolation? What is the difference between interpolating and non-interpolating basis functions?

**Question 4:** (Answer two points only) (5 Marks for each point)

a- Explain the steps of automatic gait recognition.

b- Show how we can use non-invertible transforms for cancelable biometrics.

c- Explain with the aid of sketches the idea of MACE filters that is used for face and fingerprint recognition.

**Question 5:** (Answer two points only) (5 Marks for each point)

a- How can we use bioConvolving for securing biometric data?

b- Explain the bioHashing method and how we can use it for securing biometric data.

c- Sketch the block diagram of super resolution reconstruction of images. If we have a discrete sequence $f(x_k)$ of length N as shown in Fig. (1-a) and this sequence is filtered and down-sampled by 2, we get another sequence $g(x_n)$ of length N/2 as shown in Fig.(1-b). The interpolation process aims at estimating a sequence $I(x_k)$ of length N as shown in Fig.(1-c), which is as close as possible to the original discrete sequence $f(x_k)$. Assume bilinear interpolation with:

$$\beta(x) = \begin{cases} 1-|x| & |x|<1 \\ 0 & 1 \le |x| \end{cases}$$

Find an expression for the squared error between $I(x_{k+1})$ and $f(x_{k+1})$ and minimize it as a function of s . Show that:

$$s_{opt} = \frac{f(x_{k+1}) - g(x_n)}{g(x_{n+1}) - g(x_n)}$$

Comment on this result. Explain mathematically an adaptive method to solve this problem.

**Question 6:** (Answer two points only) (5 Marks for each point)

a- Compare between salting and random projection methods for cancelable biometrics.

b- Suppose that we have two satellite images for the same area on the Earth at different times, and we want to detect the changes, how can we perform this task.

c- In your opinion, is it possible to use neural networks for applications like image enhancement or image restoration? Justify your answer.

**Total marks [35]**

## أجب عن الأسئلة التالية

### السؤال الأول: (١٣ درجه)

**ا- صح أم خطا: (٩ درجات)**

١. يجب على المهندس المشاركة في المشروعات القومية التى تحقق عائدا اقتصاديا واجتماعيا.

٢. المنظمات الهندسية من دورها التعاون مع الجهات الرسمية المختصة وتقديم المشورة والنصيحة.

٣. يجب على المهندس أن يعامل من يتفقون معه دينيا وثقافيا فقط بطريقة كريمة ونبيلة.

٤. في حالة اشتراك المهندس في النشاط العام يجب الإكثار من المصطلحات الهندسية الكبيرة وإن كانت غير مفهومة لنشر الوعى الهندسي.

٥. يجب على المهندس أن يعمل بعيدا عن الرؤى القومية والسياسات العامة.

٦. من واجبات المهندس حماية سلامة وصحة الأفراد والجماعات والحفاظ على الممتلكات.

**ب- ماذا تفعل في المواقف التالية: (٤ درجات)**

١. في حالة الرغبة فى ترك المؤسسه التى تعمل بها.
٢. إذا ما أسند إليك عمل يعتبر تعديلا أو تطويرا كليا أو جزئيا لعمل مهندس آخر.
٣. فى حالة قيام زميل بممارسات لا تتفق مع آداب وأخلاقيات المهنة الهندسية أو بعدم الالتزام بالقوانين واللوائح المنظمة لهذه المهنة

٤- اذكر أربعة نقاط من المبادئ و الأخلاقيات العامة لممارسة المهن الهندسية.

### السؤال الثانى:(١٢ درجه)

MENOUFIA UNIVERSITY

FACULTY OF ELECTRONIC ENGINEERING, MENOUF

ELECTRONIC AND ELECTRICAL COMMUNICATIONS ENGINEERING DEPARTMENT

SUBJECT: NETWORK THEORY FOR 3rd YEAR STUDENTS  TIME ALLOWED: THREE HOURS

SATURDAY: 21/01/2017

**ANSWER THE FOLLOWING QUESTIONS:**

1.a. State the three needed conditions for the system function H(s) to be positive real, where

$$H(s) = N(s)/D(s) = \sum_{i=0}^{n} a_i s^i \Big/ \sum_{j=0}^{m} b_j s^j$$

(3 Marks)

1.b. State the serious limitations of the symmetrical T-section low-pass filter (LPF) terminated with an ideal load equal to the characteristic impedance $Z_{cT}$ (2 Marks)

2. Test the following rational function to see if it is positive real

$$H(s) = (s^3+12s^2+44s+48) / (s^3+9s^2+23s+15)$$ (10 Marks)

3. Find the 1st Cauer realization of the following driving point functions

(a) $Z(s) = [(s+1)(s+3)(s+5)] / [(s+2)(s+4)(s+6)]$ (10 Marks)

(b) $Y(s) = [(s^2+1)(s^2+3)(s^2+5)] / [s\,(s^2+2)(s^2+4)(s^2+6)]$ (10 Marks)

4. Synthesize the transfer function $H(s) = V_2(s)/V_1(s)$ of a singly 1-Ω termination-two port network using two port parameters if

$$|H(j\omega)| = 1/\sqrt{1+\omega^6}$$ (15Marks)

5. Design the 3rd order Chebyshév band-pass filter ( BPF) if the bandwidth of the pass-band is $BW = 8x10^4$ rad/sec., the pass-band is centered at $\omega_o = 4x10^4$ rad/sec., the design impedance, $Z_o = 10^3\ \Omega$, the ripple in the pass-band must not exceed 0.5 dB and the transfer function, $H(s) = V_2(s)/V_1(s)$. (20 Marks)

GOOD LUCK

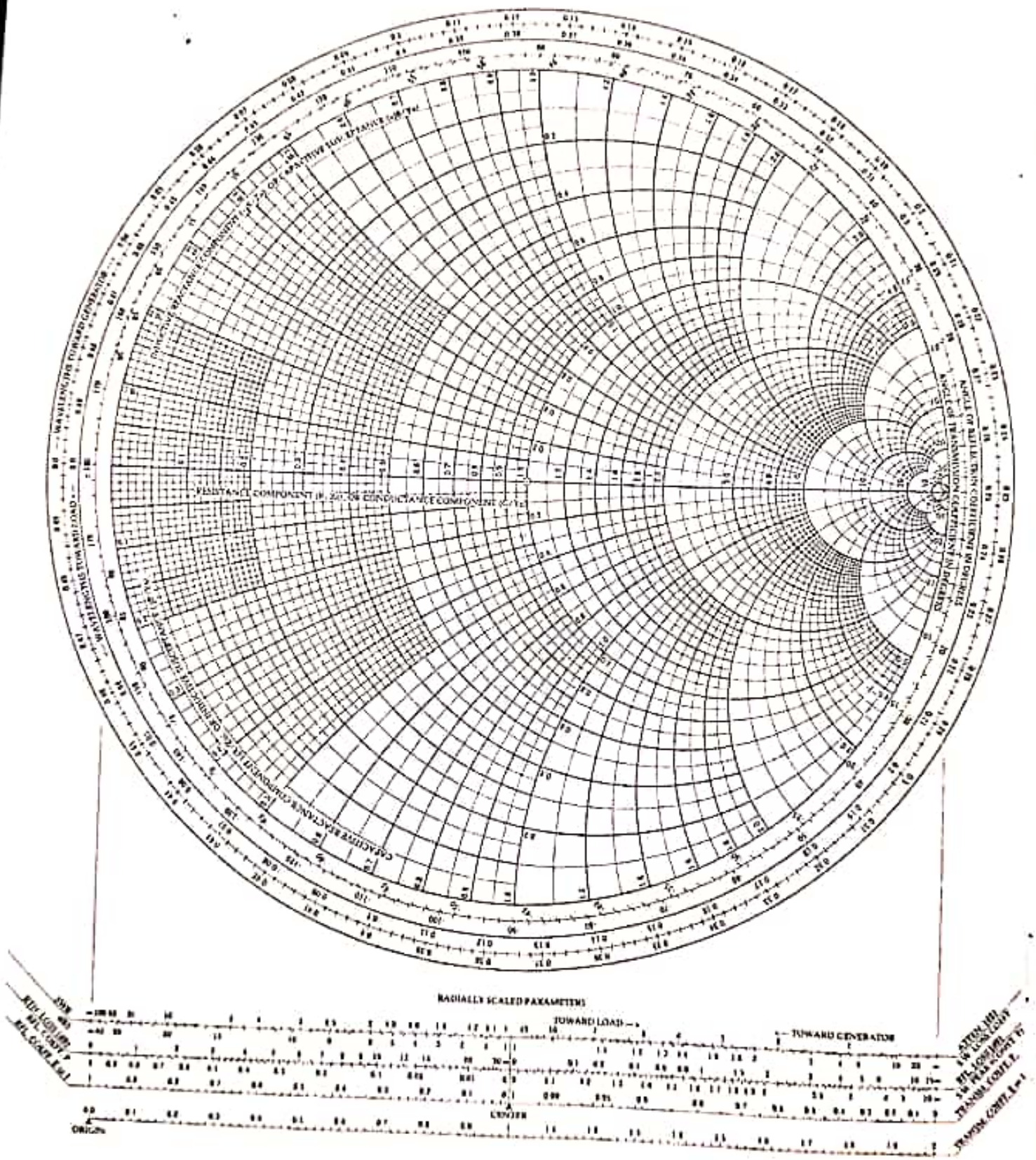
Dr. Mohamed El-Hadawany

If you need to continue the solution to a problem here, mark clearly on the page where the problem is stated that the "***solution is continued on page 16***", and on this page mark clearly which problem you are continuing.

***END OF EXAMINATION***

# The Complete Smith Chart

Black Magic Design



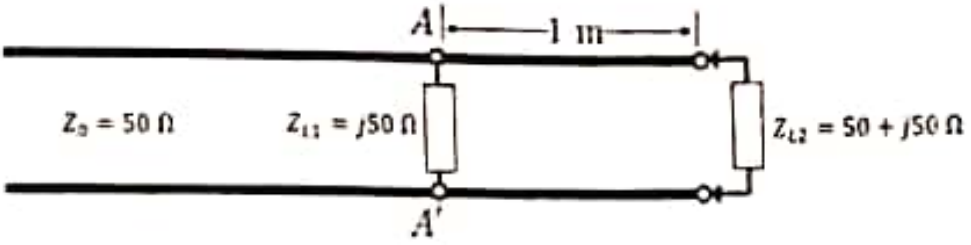
**QUESTION 5: [10 pts. total]**

A transmission line is loaded with an impedance $Z_{L1} = j50\ \Omega$ at a distance 1 m from the load $Z_{L2} = 50 + j50\ \Omega$ as shown below. If the wavelength on the line equals 5 m. Use a short-circuited parallel stub placed **to the left** of points $A$- $A'$ to match the load to the line. Using Smith chart,

(a) Find the distance $d$ where the stub should be placed (in terms of $\lambda$)

(b) What is the length of the stub $L^{stub}$ (in terms of $\lambda$)?

(c) Plot the resulting circuits.




| $d_1$ | $L_1^{stub}$ | $d_2$ | $L_2^{stub}$ |
|---|---|---|---|

C] Circle or underline the correct answer. [9 points]

1. A directional coupler has a directivity =25 dB and an isolation =40 dB. The coupling value will be
   a. 65 dB
   b. 40 dB
   c. 15 dB
   d. None of these.

2. The scattering parameters are used to express relations between
   a. Impedances and admittances of the ports.
   b. Total voltages on the ports and total currents on the ports.
   c. Voltage waves incident on the ports and those travelling away from the ports.
   d. None of these.

3. The Isolator is used to
   a. Attenuate the power level to the wanted value.
   b. Pass microwave signal at low attenuation in one direction, and not the other.
   c. Pass microwave signal in both directions at low loss.
   d. Produce phase shift for the transmitted signal in one direction, and not the other.

4. When it is required to split a microwave signal into two parts that are equal in magnitude and opposite in phase, the following matched device is used
   a. H-plane T-junction waveguide.
   b. 3-dB directional coupler.
   c. 3-port circulator.
   d. E-plane T-junction waveguide.

5. A waveguide section in a microwave circuit acts as
   a. Low pass filter
   b. Band pass filter
   c. High pass filter
   d. Band stop filter

6. A magic-Tee is nothing but
   a. A modification of E-plane tee.
   b. A modification of H-plane tee.
   c. A combination of E-Plane and H-Plane.
   d. Two E-plane tees connected in parallel.

7. An ideal directional coupler has_____ directivity, and_____insertion loss.
   a. infinity, zero
   b. zero, zero
   c. zero, infinity
   d. infinity, infinity

8. A transmission line is:
   a. A pair of wire.
   b. A special type of cable.
   c. A copper trace on a printed circuit board with ground plane.
   d. Any metallic structure with at least 2 conductors that is long compared to the wavelength of the wave guided by the structure.

9. An-air transmission line with length $l$ connects a load to a sinusoidal voltage source operating at a frequency $f$. Transmission line effects can be ignored for the case
   a. $l$ = 20 cm, $f$ = 10 KHz
   b. $l$ = 400 km, $f$ = 50 Hz
   c. $l$ = 20 cm, $f$ = 300 MHz
   d. $l$ = 1 mm, $f$ = 100 GHz

**QUESTION 4: [15 pts. total]**

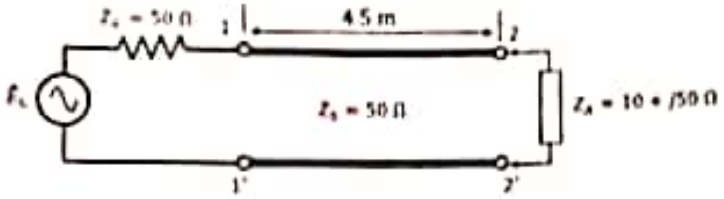
A] Explain briefly with diagrams the differences between Isolator and Circulator. **[3 points]**

B] Draw schematic of four port circulator constructed using magic tees and explain its operation. **[3 points]**

(b) The power delivered to the antenna. **[3 points]**

(c) The power reflected back to the generator. **[2 points]**

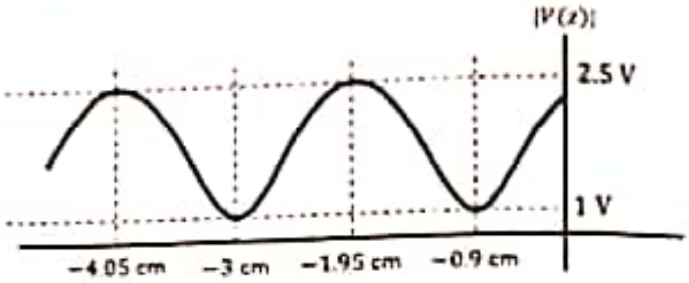
B] A radio transmitter operated at 400 MHz has an internal impedance of 50 Ω and it delivers power of 1 W to a matched load. It is connected to an antenna of impedance $Z_A = 10 + j50\ \Omega$ via a loss-free 50 Ω coaxial cable with L =0.625 [μH/m], C = 40 [pF/m] (Hint: $\mu = 10^{-6}$, $\rho = 10^{-12}$). Find




(a) The Thevenin equivalent of the transmitter together with the transmission line, i.e., with respect to terminals 2 – 2'. **[7 points]**

**QUESTION 3: [20 pts. total]**

A] The results of a slotted-line experiment are plotted in the following figure. The length of the line is $\ell = 8.4$ cm; its characteristic impedance is $Z_0 = 50\ \Omega$. Find




(a) The reflection coefficient at the load. **[2 points]**

(b) The load impedance. **[1 point]**

(c) The input impedance. **[2 points]**

(d) The reflection coefficient at the generator terminals. **[1 points]**

C] Explain impossibility of TEM wave propagation through hollow waveguide. **[3 points]**

(e) The waveguide has dimensions $a = 4$ cm and $b = 2$ cm and filled with air and $E_0 = 63.77$ V/m. Find the average power propagated inside the guide at $f = 3$ GHz. **[2 points]**

B] Draw the field patterns inside a rectangular waveguide for $TE_{20}$, $TE_{01}$, $TM_{20}$, and $TM_{01}$ modes in $xy$ and $xz$ planes. **[8 points]**

(d) Prove that the power transmitted by $TE_{10}$ mode is given by $P = \frac{E_0^2 ab}{4Z_{TE}}$, where $E_0$ is the peak electric field value (Hint: $\int_0^a \cos^2\left(\frac{\pi x}{a}\right) dx = \int_0^a \sin^2\left(\frac{\pi x}{a}\right) dx = \frac{a}{2}$). **[4 points]**

**QUESTION 2: [25 pts. total]**

A] For a rectangular waveguide supporting TE waves, we have the following electric fields:

$$\bar{E}_x = \frac{j3w\mu\pi}{k_c^2 b}\cos\left(\frac{2\pi x}{a}\right)\sin\left(\frac{3\pi y}{b}\right)e^{-j\beta z}$$

$$\bar{E}_y = -\frac{j2w\mu\pi}{k_c^2 a}\sin\left(\frac{2\pi x}{a}\right)\cos\left(\frac{3\pi y}{b}\right)e^{-j\beta z}$$

(a) What is the mode of operation? **[1 point]**

(b) What is the direction of propagation? **[1 point]**

(c) Using **Maxwell's equations** ($\nabla \times E = -jw\mu H$, $\nabla \times H = jw\epsilon E$), find the corresponding magnetic fields in the $x, y$ and $z$ directions (Hint: $\nabla \times A = \left(-\frac{\partial A_y}{\partial z}\right)\hat{x} + \left(\frac{\partial A_x}{\partial z}\right)\hat{y} + \left(\frac{\partial A_y}{\partial x} - \frac{\partial A_x}{\partial y}\right)\hat{z}$). **[6 points]**

(c) If port 2 is matched, find the reflection coefficient $\Gamma_1$ at port 1 as well as the input impedance $Z_{in1}$ at port 1. **[2 points]**

(d) Assuming that the network is fed at port 1 and the load at port 2 is $Z_0$, what is the internal impedance of the generator at port 1 such that maximum power is delivered to the network? **[2 points]**

(e) If port 2 is short-circuited, find the reflection coefficient $\Gamma_1^{sc}$ at port 1 as well as the input impedance $Z_{in1}^{sc}$ at port 1. **[4 points]**

(b) The reflected-to-incident power ratio. **[1 point]**

(c) The transmitted-to-incident power ratio. **[1 point]**

(d) The loss-to-incident power ratio. **[1 point]**

(e) What is the function of this device? **[1 point]**

B] The S-parameters of a 2-port network are given by

$$[S] = \begin{bmatrix} 0.5 + j0.5 & 0.15 - j0.05 \\ 0.95 + j0.25 & 0.5 - j0.5 \end{bmatrix}$$

The system impedance is $Z_0 = 50\ \Omega$.

(a) Is this network loss-free? Justify your answer. **[2 points]**

(b) Is this network reciprocal? Justify your answer. **[2 points]**

Menoufia University
Faculty of Electronic Engineering
Electronics and Electrical Commun. Eng. Dept.
Third Year – Second Semester
Microwave Engineering

Course Code: ECE 323

Final Examination 2016-2017
Time : 3 Hours
Date : Sunday, May 21, 2017
Total Marks: 90 Marks
Instructor : Dr. Ahmed Farghal

**ISA, you can ACE this exam!!** **Think!!**

**Instructions:**

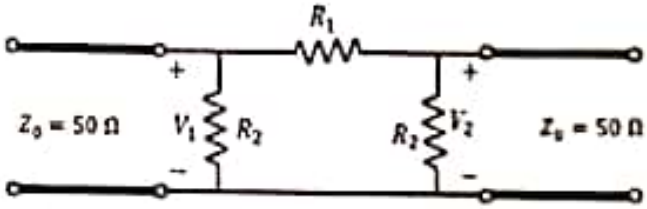
1. Answer **ALL** questions. Provide the solutions in this exam booklet.
2. There should be **16 numbered pages** (including Smith chart) in this exam.
3. Work **efficiently**. Some questions are easier, some more difficult. Be sure to give yourself time to answer all of the easy ones, and avoid getting bogged down in the more difficult ones before you have answered the easier ones.

$$\varepsilon_o = 8.854 \times 10^{-12}\ \text{F/m}, \qquad \mu_o = 4\pi \times 10^{-7}\ \text{H/m}, \qquad \eta_o = 377\ \Omega$$

**QUESTION 1: [20 pts. total]**

A] For the Π network shown below, $R_1 = 18\ \Omega$ and $R_2 = 291\ \Omega$. Find

(a) The scattering matrix. **[4 points]**



Note that: $f(z\backslash s_i)=\frac{1}{\sqrt{2\pi}\sigma_{no}}e^{-(z-a_i)^2/(2\sigma_{no}^2)}, i=1,2)$ and the likelihood ratio is

$$\Lambda(z)=\frac{f(z/s_1)}{f(z/s_2)}\underset{H_2}{\overset{H_1}{\gtrless}}.$$

**(c)** An on-off binary system uses the pulse waveforms

$$S_i(t)=\begin{cases}S_1(t)=A\sin\dfrac{\pi t}{T} & 0\le t\le T\\ S_2(t)=0 & 0\le t\le T\end{cases}$$

let A=0.2mV and T=2μs. Additive white noise with a power spectral density $\eta/2=10^{-15}$W/Hz is added to the signal. Determine the probability of error when $P(S_1)=P(S_2)=0.5$.

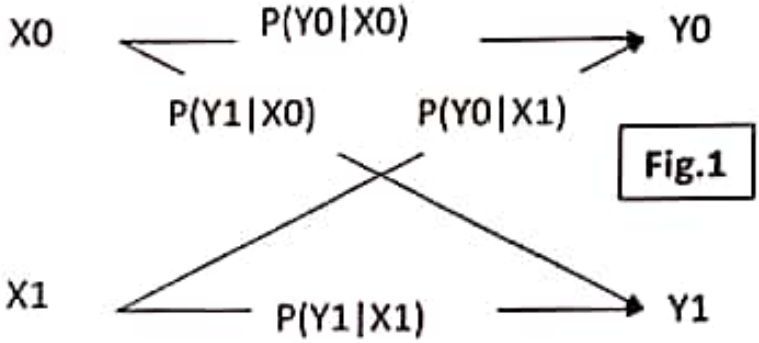



Fig.1

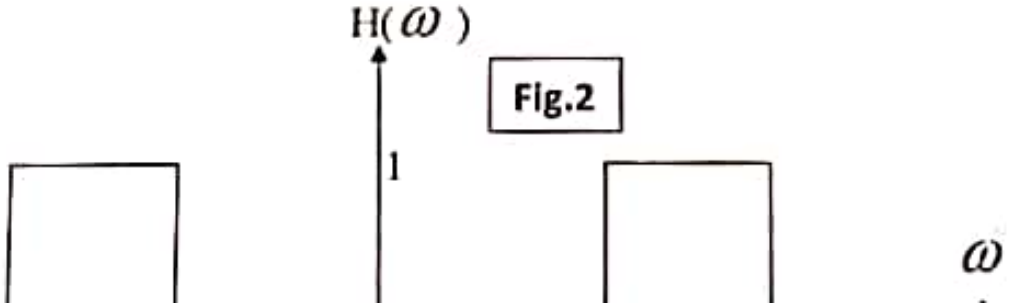



Fig.2

# *First Semester Exam*

***Title*: Random Variable and Random Process** ***Time Allowed*: 3H**

***Year*: 3rd** ***Date*:3rd Jan., 2017**

*Course coordinator: Prof Atef Abou El-azm*

## *Answer the following questions*

**Problem 1** **(8 Marks)**

Using Venn diagrams, verify the following identities.

a. $A=(A\cap B)\cup(A-B)$

b. If A and B are finite sets, we have $|A\cup B|=|A|+|B|-|A\cap B|$

**Problem 2** **(16 Marks)**

In a binary communication system (Fig.1), a 0 or 1 is transmitted. Because of channel noise, a 0 can be received as a 1 and vice versa. Let $X_0$ and $X_1$ denote the events of transmitting 0 and 1, respectively. Let $Y_0$ and $Y_1$ denote the events of receiving 0 and 1, respectively. Let $P(X_o) = 0.5$, $P(Y_1|X_o) = 0.1$, and $P(Y_o|X_1) = 0.9$.

(a)Find $P(Y_o)$ and $P(Y_1)$

(b)Find $P(X_0|Y_0)$ and $P(X_1Y_1)$ ?

(c)Calculate the probability of error $P_e$.

(d)Calculate the probability that the transmitted signal is correctly read at the receiver.

**Problem 3** **( 20 Marks)**

**(a)** If the two random processes X(t) and Y(t) are given by $X(t) = A\cos\omega t + B\sin\omega t$, $Y(t) = B\cos\omega t - A\sin\omega t$ where $\omega$ is constant and A and B are independent random variables with having zero mean and variance $\sigma^2$. Find the cross-correlation of X(t) and Y(t).

**(b)**The input *X(t)* to an ideal band pass filter having the frequency response characteristics shown in Fig.2 is a white noise process. Determine the total noise power at the output of the filter.

**Problem 4** **(26 Marks)**

**(a)** Find the output of the matched filter ($V_{out}$), and determine the maximum value of $(S/N)_o$ if the input S(t) is a rectangular pulse of amplitude A and duration T as shown in Fig.3.

**(b)** In Maximum Likelihood Detector choosing the threshold $\lambda$ is based on minimizing the probability of error. Prove that the optimum threshold $\lambda_0$ is obtained for minimizing the error probability when $P(s_1)=P(s_2)$.

**P.T.O**

**Question 7:** (Answer two points only) **(5 Marks for each point)**

a- Is it better to perform image restoration in absence or in the presence of noise? Can we use simple image enhancement methods based on low-pass and median filters in the presence of blurring? What result do you expect in this case?

b- Is it possible to hide information in digital images through the use of the discrete cosine transform? Suggest how.

c- Assume that we have performed the discrete cosine transform on an image, and then randomized the discrete cosine transform samples, and finally performed the inverse discrete cosine transform. What is the effect of this on the final obtained image?

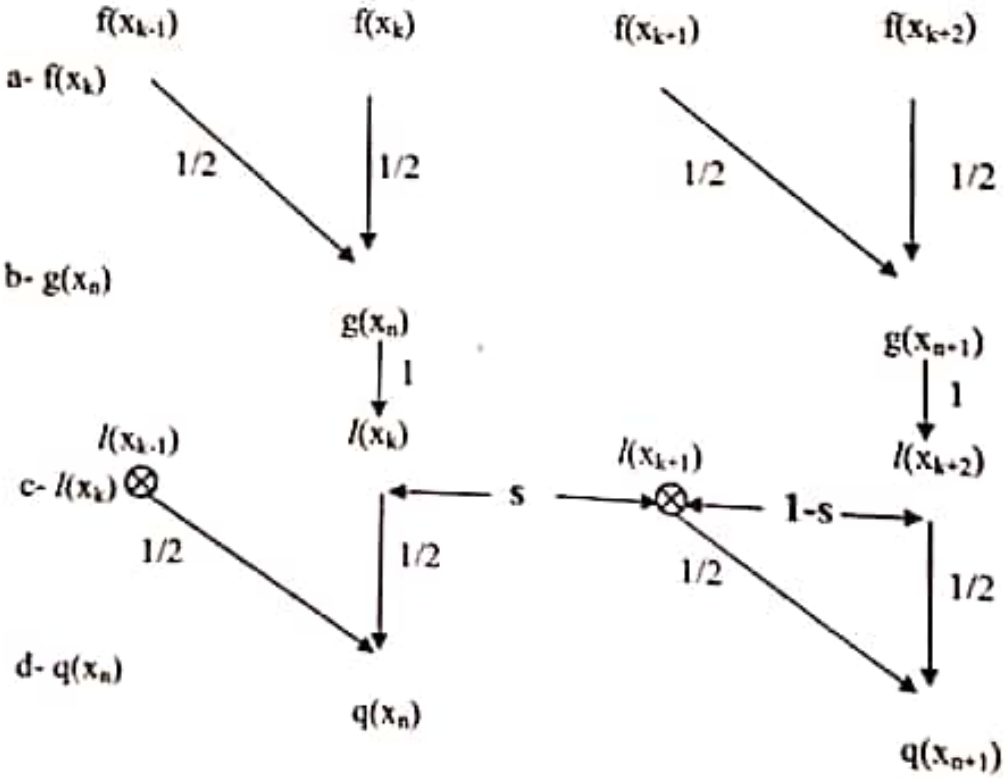



Fig.(1)

## Answer the following questions:

- a- Explain what is meant by the direct piezoelectric effect and the converse piezoelectric effect. For a piezoelectric material with an ultrasound velocity of 6000 m/sec, what thickness should a disk-shaped transducer have to provide an ultrasound beam with a frequency of 2.5 MHz?. Calculate the thickness of the transducer matching layer. (6Marks)

b- A SAW is generated on the surface of a piezoelectric substrate by mean of an ac voltage applied to an IDT at $f_o$ = 1GHz. Given that the velocity of propagation of the SAW on this material is v = 3488m/s, determine the acoustic wavelength. Compare the value of this wavelength with that of an electromagnetic wave propagating in free space at the same frequency. Determine the ratio between the SAW wavelength and the electromagnetic wavelength in this case. (8Marks)

- a- Explain, with the aid of a block-diagram and equations, the overall transfer function of an ideal linear-phase response SAW filter (4Marks)

b- A SAW filter with nominal linear-phase response employs identical uniformly apodized IDTs in input and output stages. Each IDT has N=80 electrodes. Determine (i) the approximate 4-dB percentage fractional bandwidth of each IDT and (ii) their 3-dB fractional bandwidth; (iii) indicate whether or not the overall 4-dB filter bandwidth will be the same as in (i); and (vi) determine the approximate suppression level (in dB) of the first sidelobes of the filter. (10Marks)

a- Draw and discuss the input/output equivalent circuit for a Surface Acoustic Wave (SAW) filter in the cross-field model at a center frequency $f_o$. (4Marks)

b- A SAW filter is fabricated on YZ- $LiNbO_3$. Its input and output IDTs have constant finger overlap. The input IDT has $N_p$ = 50 finger pairs and apodization width W = 100 acoustic wavelengths at a center frequency $f_o$ = 400 MHz. Consider that the capacitance/ finger pair/cm is $C_o$ = 4.6 pf/cm. Determine the numerical values of the unperturbed radiation conductance $G_a$ at $f_o$. ( For YZ-$LiNbO_3$: v = 3488m/s and $k^2$ = 4.6 % ). (10Marks)

- a- Sketch an illustrative transceiver for a digital-cellular communications transceiver, such as for the GSM , and indicate the possible location of constituent SAW components. (4Marks)

b- What are SAW wireless label identification "tags", and what are they used for?. (4Marks)

c- A SAW convolver has a rated convolution efficiency $h_c$ = - 46 dBm. If the signal input power $P_s$ is 10 dBm (10 mW) and the reference power $P_r$ is 20 dBm (100 mW), what is the correlated output power $P_{out}$?. If the output noise floor level in the previous SAW convolver is - 75 dBm, determine the output Signal-to-Noise (S/N) ratio. (6Marks)

- a- Stat the four types of acoustic sensors. and draw an equivalent circuit model to describe the interaction between a SAW and charge carriers in a film overlay. (4Marks)

b- Deposition of a 100 nm-thick AL film on a $LiNbO_3$ SAW device causes sheet conductivity vary from $\sigma_s << v_0 c_s$ to $\sigma_s >> v_0 c_s$ . (a) What acoustoelectric velocity and attenuation changes arise from this film? . (b) What is the maximum acoustoelectric attenuation (in dB) for a 100-MHz $LiNbO_3$ device with a path length of 100 $\lambda$?.( For $LiNbO_3$ $k^2$ = 4.8 % ) . (10Marks)

**Solve All Questions:**

1. **Define sensors? What are physical parameters using for sensing and the sensors devices that using to measure these physical parameters? (7 points)**

2. **Define range, error, accuracy and nonlinearity? (8 points)**

3. **Draw a circuit used as MEASUREMENT OF VOLTAGECONTROLLER: using a microcontroller? Remember its entire component and explain its operation? (10 points)**

4- **Design a 4 bits op-code simple computer with minimum devices to do these operations: ADD, SUB, MOV, MUL, and DIV with two input devices and two output devices. Give:**
   - **a- The Block diagram.**
   - **b- Table of instruction set(Op-code , Instruction(op-code + operand))**

**(10 points)**

5-**Assume that the RAM location40H-42H have the following values 40H= (47H) and 41H= (25H).**
   - **a. Draw the flow chart of summation of two numbers 57H and 15H.**
   - **b. Write a program for direct summation of 57H+15H, write the comment.**
   - **c. And then write a program to find the sum of the two numbers in these locations 40H and 41H and put the result in 43H? Write the comment.**
   - **d. Add BCD of the two numbers and correct it to hex for questions b and c.**

**Note: Make a hex decimal adjustment of AL for questions b and c.**

**(15 points)**

6- **Design a project using decoder multiplexer to control four 7-segments using 4-bits ABCD data from pic program (PIC 16F84 microcontroller) required to: -Give the block diagram of power supply circuit, the PIC with oscillator and reset bottom. The PIC also connected with the components that o/p data on 7-segment.**

**(20 points)**

**Question 4** **(13 Marks)**

(i) Let **X (t)** be a white Gaussian noise with $S_{XX}(f)=N_0/2$. Assume that **X (t)** is input to an **LTI** system with $h(t)=e^{-t}u(t)$. Let **Y (t)** be the output.

a. Find $S_{YY}(f)$.

b. Find $R_{YY}(\tau)$.

c. Find $E[Y(t)^2]$.

(ii) The input X(t) to an ideal bandpass filter having the frequency response given by $H(\omega)=\begin{cases}1 & \omega_1<|\omega|<\omega_2\\ 0 & otherwise\end{cases}$ is a white noise process. Determine the total noise power at the output of the filter. Assume $W_B=(\omega_2-\omega_1)$

**Question 5** **(10 Marks)**

Derive that the error probability performance for frequency shift keying systems uses the pulse waveforms:

$$S_i(t)=\begin{cases}s_1(t)=A\cos\omega_1 t & 0\le t\le T\\ s_2(t)=A\cos\omega_2 t & 0\le t\le T\end{cases}$$

is given by $P_e=Q\left(\sqrt{\frac{E_b}{\eta}}\right)$ where $E_b=A^2T/2$ is the average signal energy per bit. Assuming that

$$\omega_1 T\gg 1,\qquad \omega_2 T\gg 1,\qquad (\omega_1-\omega_2)T\gg 1$$

***GOOD LUCK***

*First Semester Exam* (ECE315-C1)

***Title*: Random Variable and Random Process** ***Time Allowed*: 3H**

***Year*: 3rd** ***Date*:13rd Jan., 2017**

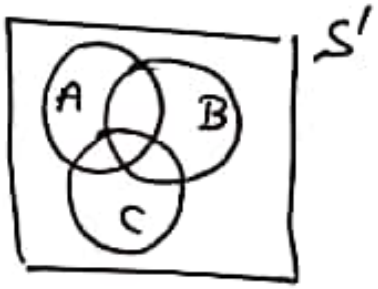
*Course coordinator:* *Prof Atef Abou El-azm*

## *Answer the following questions*

**Question 1** **(10 Marks)**

Let A, B, C be three sets as shown in the following Venn diagram. For each of the following sets, draw a Venn diagram and shade the area representing the given set.

a. $A \cup B \cup C$
b. $A \cap B \cap C$
c. $A \cup (B \cap C)$
d. $A - (B \cap C)$
e. $A \cup (B \cap C)^c$




**Question 2** **(22 Marks)**

We toss a fair coin twice, and let X be defined as the number of heads observed. Find: **(a)** the range of X, $R_X$, **(b)** Its probability $P_X(x_i)$. **(c)** Find and plot the distribution function $F_X(x)$ for the random variable X.

**Question 3** **(15 Marks)**

**(i)** Let X be a discrete random variable with range $R_X=\{0, \pi/4, \pi/2, 3\pi/4, \pi\}$,such that $P_X(0)=P_X(\pi/4)=P_X(\pi/2)=P_X(3\pi/4)=P_X(\pi)=1/5$.**Find E[sin(X)].**

**(ii)** Binary data are transmitted over a noisy communication channel in a block of **16** binary digits. The probability that a received digit is in error as a result of channel noise is **0.01**. Assume that the errors occurring in various digit positions within a block are independent.

**(a)** Find the mean and the variance of the number of errors per block.

**(b)** Find the probability that the number of errors per block is greater than or equal to 4.

**P.T.O** ➡

## الورقه الاولى

**السؤال الاول** ( ٧ درجات )

ا)ماهي المسؤليات العامه للمهندس تجاه المجتمع ؟

ب)ماهي الملكيه الفكريه ؟

ج)ماهو المبدأالاخلاقي للملكيه الفكريه وماهي قواعد السلوك مع الشرح ؟

**السؤال الثاني** ( ٧ درجات )

ا)وضح نموذج اتخاذ القرارات وحل المشكلات بالرسم .

ب) وضح العصف الذهنى وكيف يتم وماهي قواعده ؟

ج)ماهو أسلوب قبعات التفكير ؟

**السؤال الثالث**

ع المشكله الاتيه بشكل صياغه نموذج رياضي يمكن حله بنموذج البرمجه الخطيه ( ٣ درجات )

شركة جريكو لإنتاج المياه المعدنية تضع محلولين أساسين عند تصنيع المي
(معقم، ومحلي طعم):

e) *Draw the block diagram of QAM signal?* *(5 Marks)*

f) *If Bandwidth of* $g(t)$ *is n, what is the Bandwidth of* $g^2(t)$*?* *(5 Marks)*

## *Question No 4 :* *( 20 Marks)*

a) *Find the Fourier transform of* $e^{-at}u(t)$*?* *(10 Marks)*

b) *What is the difference between Baseband communication and Carrier Communication?* *(5 Marks)*

c) *Draw T1 Carrier system?* *(5 Marks)*

*Best Regards*

*Prof. Mona Shokair*

***Answer all the Following Questions :***

## *Question No 1 :*

*(20 Marks)*

a) *Explain the main difference between PCM and DPCM?* *(10 Marks)*
b) *Draw the block diagram of DPCM system?* *( 5 Marks)*
c) *How can overcome the problems of DM?* *( 5 Marks)*

## *Question No 2:*

*(25 Marks)*

a) *What are the advantages of digital communication?* *( 5 Marks)*
b) *Calculate the signal to quantization noise power ratio?* *( 10 Marks)*
c) *Approximate square signal g(t) in terms of sin t, so the energy of the error signal is minimum.*

$g(t) \approx c \sin t \qquad 0 \leq t \leq 2\pi$

*(5 Marks)*

d) *Prove that:*

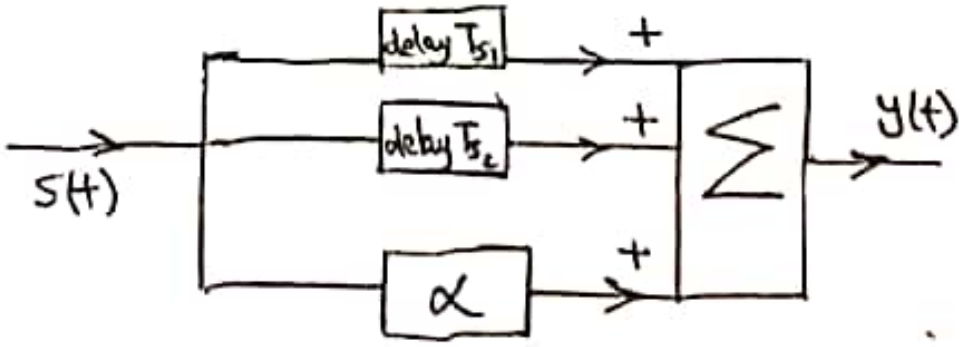
$$g(t+T) + g(t-T) = 2 \cos \omega t \, G(\omega)$$

*(5 Marks)*

## *Question No 3 :*

*( 25 Marks)*

a) *What is the meaning of negative frequency?* *(5 Marks)*
b) *What are the applications of Modulation?* *(5 Marks)*
c) *Calculate the o/p Y (ω) for the following Figure?* *(5 Marks)*



اسم الطالب \ الطالبة ..... الفصل: .....

**Answer the followings Questions**

**$Q_1$:** Describe the most important specifications for ***transmitters*** and ***receivers*** circuits. A mobile phone receiver has a sensitivity of **0.2μV** and a blocking dynamic range of **50dB**. What is the strongest signal that can be present along with a **0.2μV** signal without blocking taking place? **(2M)**

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**$Q_2$:** Determine the bandwidth of a frequency synthesizer uses a PLL to synthesize a **0.1**-MHz signal from a **0.5kHz** reference frequency. A typical value for $K_d$ is **0.5 V/rad**, and a typical value for the VCO gain factor $K_o$ (for a **0.1-MHz** VCO) is **1 kHz/V** (no filter). What value of low-pass filter should be used so that the closed-loop system approximates a second-order Butterworth filter? Compute the new bandwidth, the corresponding system rise time and hold in range (lock range).

**(3M)**

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|---|---|---|---|---|---|
| *University* | : | *Menoufia* | | *Date* | : *28/04/2017* |
| *Faculty* | : | *Electronic Engineering* | | *Time* | : *1 Hour* |
| *Department* | : | *Electronic and Comm.* | | *No. of pages* | : *1* |
| *Academic level* | : | *3rd Year* | | *Full Mark* | : *20 Marks* |
| *Course Name* | : | *Mobile Comm. Systems* | | *Exam* | : *Main term Exam* |
| | | | | *Examiner* | : *Prof. Mona* |

**Answer all the following Questions :**

***Question No 1 :*** **(10 Marks)**

a) *Draw the block diagram of GSM transmitter and explain each stage?* *(5 degrees)*

b) *How can CDMA system overcome the problem of frequency selective fading?* *(5 degrees)*

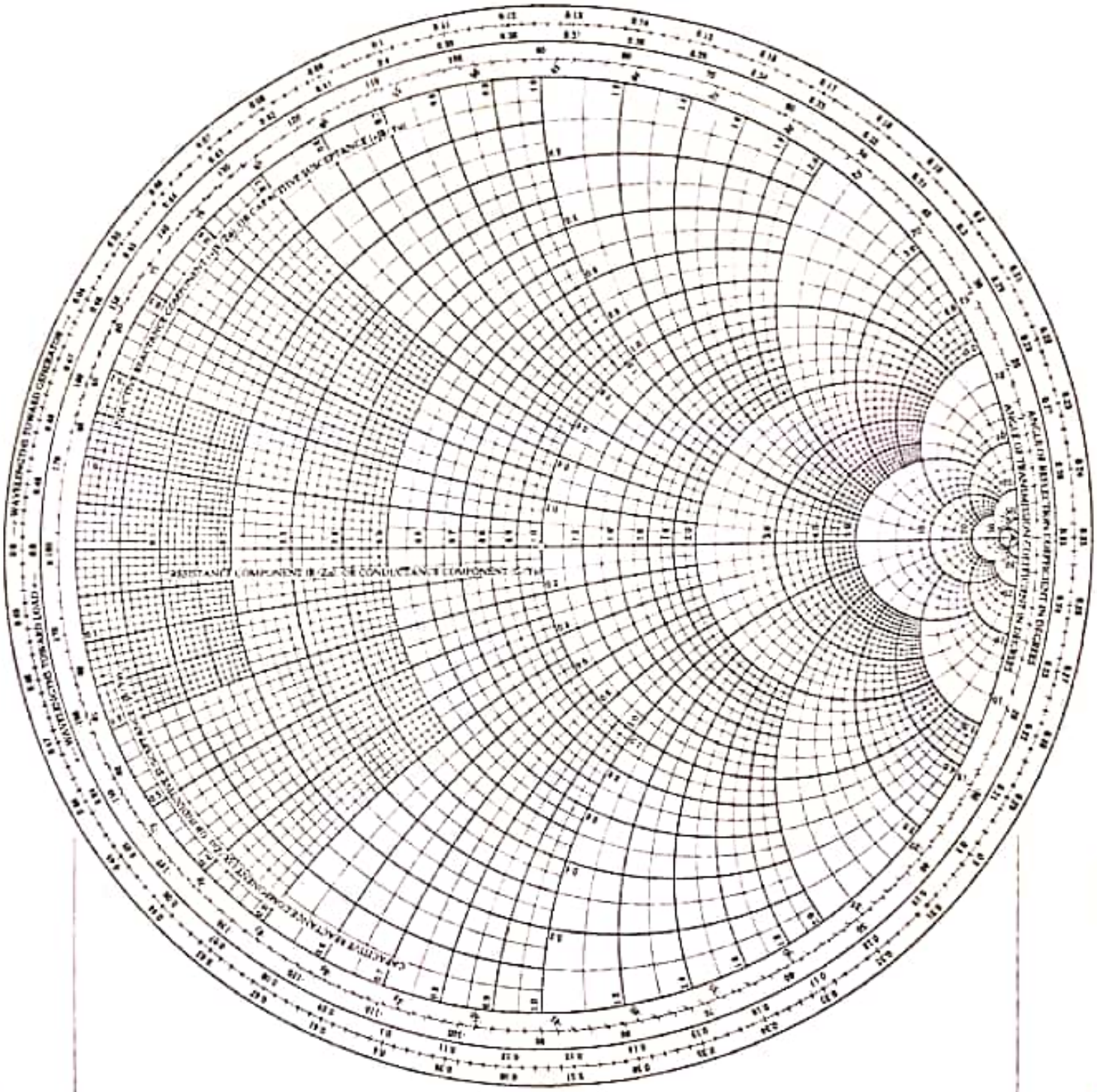
***Question No 2:*** **(10 Marks)**

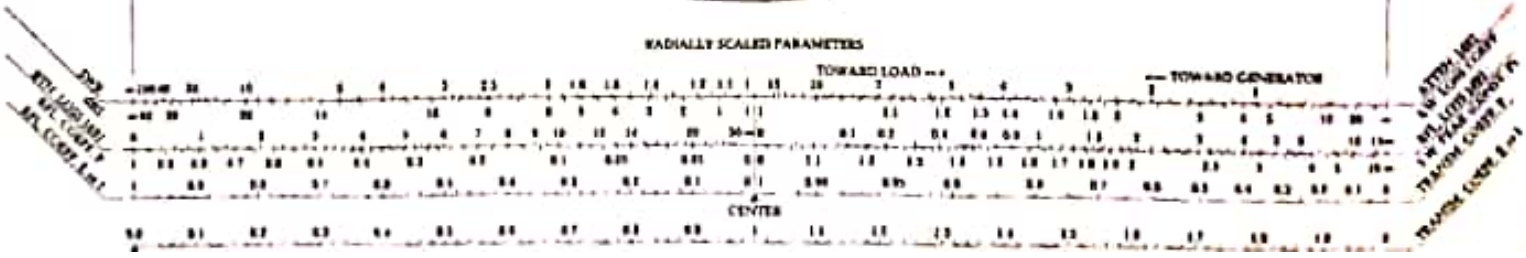
a) *How can PRMA protocol improve data transmission?* *(5 degrees)*

b) *Calculate wavelength, duplex distance and number of channels of GSM 1800 where downlink frequency (1805-1880) MHz and uplink frequency (1710-1785) MHz?* *(5 degrees)*

# The Complete Smith Chart

## Black Magic Design





a. (2 pts.) Find the standing wave ratio on each line.

b. (2 pts.) Find the time-average power delivered to each impedance $Z_1 = 150\ \Omega$ and $Z_2 = +j150\ \Omega$.

**Question 2:** [4 pts.]

2. The voltage and current expressions that were measured on a lossless transmission line are:

$$v(z,t) = 100\cos(2\pi \times 10^{10}t - \pi z + \pi/6) + 50\cos(2\pi \times 10^{10}t + \pi z)$$
$$i(z,t) = 1.0\cos(2\pi \times 10^{10}t - \pi z + \pi/6) - 0.5\cos(2\pi \times 10^{10}t + \pi z)$$

a. (1 pt.) Determine the voltage phasor.

b. (1 pt.) Determine the current phasor. How could you physically interpret the minus sign?

c. (1 pt.) Determine the impedance of the load.

d. (1 pt.) Determine the reflection coefficient at the load.

**Question 3:** [2 pts.]

I. (1 pt.) What does this picture represent?

II. (1 pt.) Most RF and microwave instruments and coaxial cables have standardized impedance of 50 Ω. Briefly state why?

Name:_____ Sec: _____

Score:

Question 1_____of possible 5 points

Question 2_____of possible 4 points

Question 3_____of possible 2 points

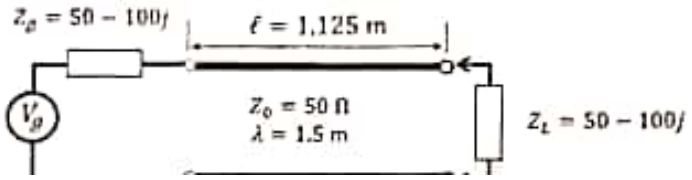
Question 4_____of possible 4 points

Total _____of possible 15 points

Answer the following questions:

**Question 1: [5 pts.]**

1. Consider the transmission line circuit below. Assume lossless line.



***Question No 3:*** **( 3 Marks)**

**Draw the block diagram of the imaging system.**

**Total: 15 Marks**

توقيع أستاذ المادة :-

أ. د/ عبدالعزيز ابراهيم محمود حسنين



**( 3 Marks)**

***Question No 2:***

**Write the procedure steps of the image reconstruction which can be carried out from the calculated scattered electric field.**

ج- اذكر بعض أنواع ملفات الاختراق للحاسب الالي ثم وضح كيفية حماية الحاسب والتخلص من هذه الملفات؟ (٤ درجات)

**السؤال الثالث: (١٠ درجات)**

ا-عرف الجوده واذكر الاخطاء الشائعه فى مفهوم الجوده والتى تعيق الاهداف المرجوه منها ؟ (4 درجات)

ب-اذكر ابعاد الجوده ومحدداتها ومتطلباتها؟ (٣ درجات)

ج-اذكر تعريف الجوده الشامله واهميتها؟ (٣ درجات)

*Best Regards*

*Prof. Gomaa- Prof. Mona - Dr.Maha*