Note: Answer All The Questions. (12 Marks)

Q1 Answer the following questions: (Six only)
1. What kinds of charges repel each other and what kinds attract each other?
2. Why are circuits protected by fuses?
3. Do all conductors permit the current to flow at the same rate?
4. How volt is defined in numerical terms?
5. Who discovered electromagnetism? How did he discovered it?
6. What does electronics deal with?
7. What term is used to describe the height of a wave? What does the term frequency describe? (12 Marks)

Q2 Fill in spaces in the following sentences with the appropriate word or phrase: (Six only)
1. A ____________ is a space from which matter has been removed.
2. In 1906 Lee De Frost made significant advance in the use of vacuum tubes when he invented the triode which contained a third electrode called a ____________.
3. Thomson's discovery led to further experimentation into the structure of the atom which led to the creation of the science of ____________.
4. The ancient Greeks discovered a kind of iron ore which possessed the ability to attract or repel iron. This property is called ____________ and an object possess it is called a ____________.
5. In actual practice many circuits and electrical appliances are ____________ for safety reasons.
6. There are two basic kinds of circuits depending on the way the electrical equipment is connected. They are ____________ and ____________.
7. The two plates of the cell are called ____________ and are placed in a solution known as ____________. (12 Marks)

Q3 Decide if these statements are true or false: (Six only)
1. The electrolytic process is used in refining aluminum from bauxite ore.
2. Current is the flow of free electrons through a conductor.
3. Its fact that like charges attract each other while the different charges repel each other.
4. In series circuit the piece of equipment are connected by wires that give of the current only one path to follow.
5. Semiconductors are midway between conductors and insulators.
6. A magnet does not simply exert a force of attraction in a straight line from one pole to another.
7. Electron is a subatomic particle first called a corpuscle.
Q4 Complete the gaps with the correct word: (Six only)

(property, reflection, consists of, insulator, strength, important, light)

1. A perfect ________ for electrical applications would be a material that is absolutely unconducting.

2. Sonar is acronym for sound Navigation and Ranging a detection system based on the ______ of under water sound waves.

3. Ohm's low is one of the most ______ law's in physics.

4. A basic fiber optic system ______ a transmitting device, an optical fiber cable and a receiver.

5. Lines of force are lines showing the direction and ______ of the forces exerted with in a magnetic field.

6. Charge is the ______ of matter which causes it to attract or repel.

7. The electron is very ______ in weight and can be drawn out of its orbit around the much heavier nucleus.

Q5 Read the passage and then answer the questions: (Six only)

**Engine**, machine for converting energy into motion or mechanical work. The energy is usually supplied in the form of a chemical fuel, such as oil or gasoline, steam, or electricity, and the mechanical work is most commonly delivered in the form of rotary motion of a shaft.

Engines are usually classified according to the form of energy they utilize, such as steam, compressed air, diesel, and gasoline; the type of motion of their principal parts, such as reciprocating and rotary; the place where the exchange from chemical to heat energy takes place, such as internal combustion and external combustion; the method by which the engine is cooled, or water-cooled; the position of the cylinders of the engine, such as V, in-line, and radial; the number of strokes of the piston for a complete cycle, such as two-stroke and four-stroke; the type of cycle, such as Otto (in ordinary gasoline engines) and diesel; and the use for which the engine is intended, such as automobile and airplane engines.

Engines are often called motors, although the term motor is sometimes restricted to engines that transform electrical energy into mechanical energy. Other specialized engines are the windmill, gas turbine, steam turbine, and rocket and jet engines.

1. What is the engine?
2. What is the difference between the engine and the motor?
3. What fuels are used in order to supply energy to the engine?
4. What is the chemical energy of fuel transformed into in engines?
5. What criteria are used for the classification of engines?
6. How energy usually supplied?
7. Give examples for specialized engines?

Good Luck
NOTE: Answer all the questions.

Q1 (12 marks): Using superposition theorem, find \( I \).

Q2 (12 marks): For the circuit shown, the switch was open for a long time, then it is closed at \( t=0 \). Find \( i_L \) for \( t>0 \).

Q3 (12 marks): For the waveform shown beside, find \( I_{rms} \).

Q4 (12 marks): For the circuit shown beside, find Thevenin's equivalent between a and b.

Q5 (12 marks): For the circuit shown beside, find:
   a- Total number of Watts.
   b- Total number of VAR's.
   c- Total number of VA's.
   d- Sketch the power triangle, and the circuit phase angle. (please be sure of your results above, otherwise the following will be incorrect)
   e- What level of capacitance you can add to the circuit to raise the p.f. to unity.
   f- On the circuit diagram, indicate where you must put the capacitor.
Q1: Draw with scale (1:1) the "Linkage Plate" shown in figure 1. (6 Marks)

Q2: Draw with scale (1:1) the front, top and right-side views of the body shown in figure 2. (10 Marks)

Q3: From the given front, top and left-side views in figure 3, use scale (1:1) to do the isometric (3D) drawing of the "Fork". (9 Marks)
ملاحظة: الإجابة على جميع الأسئلة وكل سؤال (15) درجة

س١: عدد الحقوق والحريات الفكرية؟ واشرح حرية العقيدة أو الديانة؟

س٢: يعتبر الحق في التعليم من الحقوق الثقافية التي أكّدت عليها الشريعة الإسلامية والاتفاقيات الدولية.

س٣: تكلّم عنه بالتفصيل؟

س٤: تكلم عن حق الرعاية الخاصة بالأمومة والطفولة باعتبارها من الحقوق الاجتماعية التي يتقاضى بها الإنسان؟

س٥: وضح ضمانات حقوق الإنسان في الفقه الغربي مع الشرح؟

تمنياتي لكم بالنجاح والتوفيق.
Note: Attempt all question.

Q1-A Write C++ program to compare between the last (100) long double element from the binary file (C:\BB\AA.BIN) and the first (100) long double element from file (E:\KK\AA.TXT).

Q1-B What is the difference between binary files and text files, list at least four different.

Q2- Write a program to accept ten element float array, and print the result Sum (....)/Max (....) of the array.

Q3- Write a program to print prime numbers between 50 to 500, using while statement.

Q4- if I = X7 X6 X5 X4 X3 X2 X1 X0 Write C++ piece of code that make J=X1X0X2 X300 x6 X7.

-------------- Practical (15 Marks) ---------------

Note: Attempt all question.

Q1- What is the difference between (Ctrl + F1) and (Alt + F1) in the integrated environment of C++.

Q2- Write a program to print character diamond with diagonal = 11 character using for statement.

Q4- Program to accept any single digit number and print it in words.

Good Luck
Q1: Fill in the blank with suitable phrase of the following. (10 Marks)

1. ............: A powerful multi-user computer capable of supporting many hundreds or thousands of users simultaneously.

2. ......connector is a keyed connector used to connect to a floppy drive.

3. The Universal Serial Bus (USB) devices are ................., which means that users can connect and disconnect the devices while the computer is powered on.

4. ....................... is a 32-bit expansion slot. It is designed for video adapters.

5. .............. is a 32 bit expansion slot. This is older technology and is seldom used.

6. The operating system enables the user to interact with software and hardware. There are two types of user interfaces:.............. and..............

7. .............. is the buildup of an electric charge resting on a surface. This buildup may destructive to the electronic component and cause damage.

8. A single USB port in a computer can support up to ........ separate devices with the use of multiple USB hubs.

9. ............. devices are used to transmit and receive data using radio waves.

10. ............... address that is "burned-in" or permanently programmed into the NIC when manufactured. This address cannot be changed.

Q2: A- Answer five of the following. (10 Marks)

1. Why laptop processors don't require cooling devices that are large as these found in desktop?

2. Which power mode would you use on a laptop running Windows XP to minimize power consumption by reducing power to the hardware?

3. Compare between the different Mobile Phone Standards.

4. How can measured the speed of a laser printer?

5. A computer must have an interface to access a printer. Give three type of interface.

6. What is the benefit of healing mechanism in inkjet printer?

B- Define three of the following: (3 Mark)

thermal printer, Standby, Laser printers, discharge mechanism.

Q3: A-Compare between each of the following: (8 Mark)

1. Desktop OS and Network OS 2. FAT32 and NTFS 3. Multi-mode and Single-mode

4. Half-duplex and Full-duplex

B- Explain in detail each of the following: (4 Mark)

1. IP address

2. Bandwidth

3. Token passing

4. Cluster
Practical part

Q4: Choose the correct answer/s from the questions below: (6 Mark)

1. What is the function of a fan on top of a heat sink?
   - to cool the memory modules
   - to move the heat away from the CPU
   - to draw cool air into the computer case
   - to provide a water-cooling system for extremely fast CPUs

2. A technician has installed a new sound card in a PC but it is not operating correctly. Where should the technician look to investigate driver problems?
   - Computer Management.
   - Device Manager.
   - My Computer.
   - System Tools.

3. What is a function of a video adapter card?
   - stores video files in RAM
   - connects a computer to a video storage device
   - provides the appropriate drivers for the monitor
   - provides an interface between a computer and a display monitor

4. Which of the following is not an example of software maintenance?
   - Remove unwanted programs
   - Clean the mouse and keyboard
   - Review driver updates
   - Review security updates
   - Review software updates

5. What are two factors that must be considered when choosing a computer case? (Choose two.)
   - the size of the monitor.
   - the vendor that manufactured the motherboard.
   - the number of external or internal drive locations.
   - the size of the motherboard and the power supply.
   - the number of LED indicators at the front of the case.

Q5: Answer the following equation: (4 Mark)
   A- what is control panel? Describe it briefly.
   B- Describe task scheduler, find out any task and then schedule it.

Q6: Explain briefly: (5 mark)
   RAM, ROM, Standoffs, thermal compound, RJ45
[Note: Attempt all questions and each question carries equal marks]

Q1\ A- If the angular momentum of the rotating electron in the atom is \( mvr = n \frac{h}{2\pi} \) and the electron velocity has the following relationship \( v^2 = \frac{e^2}{4\pi\varepsilon_0 rm} \) prove that the radius of the electron's rotation is \( r = \frac{h^2\varepsilon_0}{e^2 \pi m} n^2 \).

B- The total energy of an electron in 2\(^{nd}\) state is \(-3.4\text{ev}\). Find its work and its kinetic energy in this state and the radius of the orbit?

Q2\ A- Consider a bar of n-type silicon containing the thermal-equilibrium concentration \( p_0 \) and \( n_0 \). Assume that at \( t = t' \) the specimen is illuminated and the additional hole-electron pairs are generated uniformly throughout the crystal. Prove that the excess carrier density returns to zero exponentially with time as shown in figure below.

\[ p = p_0 + p'(0)e^{-t/r_p} \]

Q3\ A- Determine the change in the diode voltage corresponding to a 20:1 change in current for diode operating at 27\(^{\circ}\text{C}\).

B- What are the main differences between the LEDs and the photodiodes?

Q4\ A- Describe the basic operation of the laser diode and the solar cell?

B- Explain the types of the diode logic gates?
Q5\ Determine the Q-point and the maximum peak value of \( I_B \) for the circuit below? take \( \beta = 200 \).

![Circuit Diagram]

Q6\ A- Determine the output voltage waveform for the circuit in figure blow? What is the name of this circuit? \( V_{\text{in}} = 10v \), \( V_D = 0.3v \) and \( V_B = 3v \).

![Circuit Diagram]

B- Determine the output voltage waveform for the circuit in figure blow? What is the name of this circuit? \( V_B = 3v \), \( V_{B1} = 6v \), \( V_{D1} = 0.7v \) and \( V_{D2} = 0.3v \).

![Circuit Diagram]

**List of constants:**

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Charge of electron</td>
<td>( 1.6 \times 10^{-19} ) C</td>
</tr>
<tr>
<td>Permittivity of space</td>
<td>( 8.85 \times 10^{-12} ) F/m</td>
</tr>
<tr>
<td>Boltzmann constant</td>
<td>( 1.38 \times 10^{-23} ) J/K</td>
</tr>
<tr>
<td>Mass of electron</td>
<td>( 9.1 \times 10^{-31} ) Kg</td>
</tr>
<tr>
<td>Plank's constant</td>
<td>( 6.626 \times 10^{-34} ) J.s.</td>
</tr>
</tbody>
</table>
Attempt all questions and using calculator is not allowed

Q1) A- Simplify the following Boolean functions by means of the tabulation method (Quine-McCluskey): \( P(A,B,C,D,E,F) = (20,28,52,60). \) (8 Marks)

B- Design 16X1 multiplexer using 4X1 multiplexers only. (5 Marks)

Q2) A- What are the differences between combinational logic circuits and sequential logic circuits, give an examples for both of them. (4 Marks)

B- Complete the timing diagram shown in figure 1. (4 Marks)

C- Convert the following system numbers. (4 Marks)

1- \((0.513)_{8}\) to decimal
2- \((0.6875)_{10}\) to binary
3- \((13597)_{10}\) to BCD
4- \((4310)_{5}\) to decimal

Q3) A- The circuit shown in figure 2. (5 Marks)
1- Write the \( f \) equations.
2- Redesign the circuit to implement the same functions with minimal logic gates.
B- Use Karnaugh maps (K-maps) to simplify the following functions in Product-of-Sums and then design with minimal logic gates.

\[ f(W,X,Y,Z) = \prod M(4,7,8,11) + \Sigma d(1,2,13,14) \] (5 Marks)

**Practical Part**

Q1\ Design a comparator unit by using the 74HC85 TTL IC comparator to compare the magnitude of two 16-bit numbers, the comparison result should be shown at 7-segment display connected to 7448 TTL IC decoder according to the table shown below.

<table>
<thead>
<tr>
<th>( A_0-A_{15} )</th>
<th>( B_0-B_{15} )</th>
<th>Display</th>
</tr>
</thead>
<tbody>
<tr>
<td>( A=B )</td>
<td>( A&gt;B )</td>
<td>( A&lt;B )</td>
</tr>
<tr>
<td>2</td>
<td>4</td>
<td>8</td>
</tr>
</tbody>
</table>

(8 Marks)

Q2\ Use (U7:74280) parity bit generation TTL IC to construct a circuit that transmit and receive 6-bit data with bit parity and check if the received data is correct or not. (7 Marks)
س1: أكمل القراءات الناقصة (قيمة وإتجاهها) في هذا الجدول اعتمادًا على الدائرة المبينة أدناه.

<table>
<thead>
<tr>
<th></th>
<th>$I_1$</th>
<th>$I_2$</th>
<th>$I_3$</th>
</tr>
</thead>
<tbody>
<tr>
<td>يوجد المصدر</td>
<td></td>
<td></td>
<td>1A</td>
</tr>
<tr>
<td>28V</td>
<td></td>
<td>↓</td>
<td>2A</td>
</tr>
<tr>
<td>7V</td>
<td>←</td>
<td></td>
<td>3A</td>
</tr>
</tbody>
</table>

س2: ما هو العنصر المفقود في الدائرة التالية؟ ولماذا?

س3: اشرح اختصار الفرق بين طريقة ربط كل من:
1. الفازوريمتر
2. الأميتر
3. الأوميتر

للقياس في دائرة كهرو بائية.
س 4: للدائرة الموضحة في الشكل، اغلاق المقناة S عند الزمن t = 0، فكانت قراءات الفولتية VC مع الزمن t كما موضح في الجدول أدناه، حدد ثابت الزمن (τ) بشكل تقريبي، قيمة المتسعة (C).

<table>
<thead>
<tr>
<th>t(sec)</th>
<th>Vc</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>17</td>
<td>3.06</td>
</tr>
<tr>
<td>27</td>
<td>3.93</td>
</tr>
<tr>
<td>50</td>
<td>5.13</td>
</tr>
<tr>
<td>80</td>
<td>5.68</td>
</tr>
<tr>
<td>120</td>
<td>5.88</td>
</tr>
<tr>
<td>140</td>
<td>5.92</td>
</tr>
<tr>
<td>160</td>
<td>5.92</td>
</tr>
</tbody>
</table>

C=1F

س 5: ارسم تيار المتسعة من خلال الرسم أدناه، علمًا أن

C=1F

س 6: للدائرة أدناه حدد كل من (CH1, CH2, Com) على الرسم لابجاد زاوية فرق الطور لكل مما يلي:
R1,R3 - 6 L2,L1 - 5 C2,C1 - 4 R2,C1 - 3 L1,R1 - 2 للدائرة 1 - للدائرة
س7: أجريت قياسات للتيار والفولتميتر عند تغيير مقاومة الحمل لإحدى شبكات التيار المستمر الكهربائية وكانت القياسات كما في الجدول أدناه:

<table>
<thead>
<tr>
<th>$I_L (mA)$</th>
<th>1.88</th>
<th>1.5</th>
<th>1.25</th>
<th>1</th>
<th>0.75</th>
</tr>
</thead>
<tbody>
<tr>
<td>$V_L (V)$</td>
<td>8.112</td>
<td>15</td>
<td>17.5</td>
<td>20</td>
<td>22.5</td>
</tr>
</tbody>
</table>

جد مكافئ تقنل للشبكة.

س8: للرسم الموضح في الشكل المجاور:
1. جد زاوية فرق الطور بين الموجتين (A,B) من الرسم معتبرا الموجة A كمرجع.
2. جد قيمة كل مما يأتي:

- $V_{(peak to peak)}$ for A
- $V_{peak}$ for B
- $V_{rms}$ for A & B

$\text{Voltage Scale} = 4V/DIV$  
$\text{Time Scale} = 5\text{msec/DIV}$
Answer any 4 questions

Q1
Design a digital highpass Butterworth filter with the following specifications...
- 3 dB attenuation at the passband frequency of 3 kHz
- 10 dB stopband attenuation at the frequency of 1.5 kHz
- Sampling frequency of 8,000 Hz

Calculate frequency response (magnitude) at 1 kHz and 5 kHz

Q2
Design a 5-tap FIR highpass filter with cutoff frequency 1500 and sampling rate...

Of 8000 Hz Using
- Hamming window

-Determine the transfer functions and difference equation
-Compute the magnitude frequency response at 1000 Hz and 4000 Hz

Q3
3-1-The spectrum of the sampled signal $X(W) = \sum_{n=-\infty}^{\infty} X(W-nW_s)$...

-Prove that

3-2-for the signal $x(t) = 4.5*\sin(2500*\pi*t)$...

-Determine the number of bits for ADC (-10--10V) to have SNRdB= 45
- The minimum sampling frequency
- The digital value and quantization error for $x(t)$ at t=1/5000 Sec

$$SNR_{dB} = 10.79 + 20 \cdot \log_{10} \left( \frac{X_{rms}}{\Delta} \right)$$

Q4
4-1-Draw the Z-Plane corresponding to the following S-Plane Coordinates...
- $\sigma = 0 \rightarrow -\infty , W = 0$
- $\sigma = 0 \rightarrow \infty , W = 0$
- $\sigma = 0 \rightarrow -\infty , W = \text{Constant}$

4-2-find Z- transforms inverse using long division method for...

$$X(z) = \frac{(1+2z^{-1}+z^{-2})}{(1- Z^{-1} + 0.3561Z^{-2})}$$

Q5
5-1-Given impulse response for the system as shown...

$h(0) = 1, h(1) = 2, h(2) = 2, h(3) = 4$

-Find the response for the system for unit step input using graphical method
- Find the response for the system for unit step input using convolution theorem

(Using Z-Transform for unit step u(n) = 1 + Z^{-1} + Z^{-2} + Z^{-3})

5-2-for the signals...

$x(n) = 1101, y(n) = 1001$
- Calculate DFT X(k) and DFT Y(k) using the decimation-in-frequency FFT method.
- Calculate cross correlation using correlation theorem
Data Sheets

Butterworth Filter Design

\[ h(s) = \frac{1}{s+1} \]  
\[ \varepsilon^2 = 10^{0.1A_p} - 1 \]  
\[ n \geq \frac{\log_{10} \left( \frac{10^{0.1A_p} - 1}{\varepsilon^2} \right)}{2 \cdot \log_{10}(v_s)} \]

TABLE 8.1 Analog lowpass prototype transformations.

<table>
<thead>
<tr>
<th>Filter Type</th>
<th>Prototype Transformation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lowpass</td>
<td></td>
</tr>
<tr>
<td>Highpass</td>
<td></td>
</tr>
<tr>
<td>Bandpass</td>
<td></td>
</tr>
<tr>
<td>Bandstop</td>
<td></td>
</tr>
</tbody>
</table>

\( \omega_c \), \( \omega_c \) is the cutoff frequency
\( \omega_c \), \( \omega_c \) is the cutoff frequency
\( \frac{s^2 + \omega_0^2}{sW} \), \( \omega_0 = \sqrt{\omega_l \omega_h} \), \( W = \omega_h - \omega_l \)
\( \frac{s^2 + \omega_0^2}{sW} \), \( \omega_0 = \sqrt{\omega_l \omega_h} \), \( W = \omega_h - \omega_l \)

Analog Filter Specifications

<table>
<thead>
<tr>
<th>Lowpass: ( \omega_{ap}, \omega_{as} )</th>
<th>Lowpass Prototype Specifications</th>
</tr>
</thead>
<tbody>
<tr>
<td>Highpass: ( \omega_{ap}, \omega_{as} )</td>
<td>( v_p = 1, v_s = \omega_{as}/\omega_{ap} )</td>
</tr>
<tr>
<td>Bandpass: ( \omega_{apl}, \omega_{aph}, \omega_{asl}, \omega_{ash} )</td>
<td>( v_p = 1, v_s = \omega_{as}/\omega_{ap} )</td>
</tr>
<tr>
<td>Bandstop: ( \omega_{apl}, \omega_{aph}, \omega_{asl}, \omega_{ash} )</td>
<td>( v_p = 1, v_s = \omega_{as}/\omega_{ap} )</td>
</tr>
<tr>
<td>( \omega_0 = \sqrt{\omega_{ap}\omega_{aph}}, \omega_0 = \sqrt{\omega_{asl}\omega_{ash}} )</td>
<td>( \omega_0 = \sqrt{\omega_{apl}\omega_{aph}}, \omega_0 = \sqrt{\omega_{asl}\omega_{ash}} )</td>
</tr>
</tbody>
</table>

\( \omega_{ap} \), passband frequency edge; \( \omega_{as} \), stopband frequency edge; \( \omega_{apl} \), lower cutoff frequency in passband; \( \omega_{aph} \), upper cutoff frequency in passband; \( \omega_{asl} \), lower cutoff frequency in stopband; \( \omega_{ash} \), upper cutoff frequency in stopband; \( \omega_g \), geometric center frequency.

FIR Window Design

Hamming window:

\[ w_{ham}(n) = 0.54 + 0.46 \cos \left( \frac{2\pi n}{M} \right), \quad -M \leq n \leq M. \]

Blackman window:

\[ w_{black}(n) = 0.42 + 0.5 \cos \left( \frac{2\pi n}{M} \right) + 0.08 \cos \left( \frac{4\pi n}{M} \right), \quad -M \leq n \leq M. \]

Highpass:

\[ h(n) = \begin{cases} \frac{\Omega_c}{\pi} & n = 0 \\ \frac{\sin (\Omega_c n)}{n \pi} & \text{for } n \neq 0, \quad -M \leq n \leq M \end{cases} \]

Lowpass:

\[ h(n) = \begin{cases} \frac{-\sin (\Omega_c n)}{n \pi} & n = 0 \\ \frac{\sin (\Omega_c n)}{n \pi} & \text{for } n \neq 0, \quad -M \leq n \leq M \end{cases} \]

\( f_c = (f_{pass} + f_{stop})/2. \)

\( \Delta f = \frac{|f_{stop} - f_{pass}|}{f_s} \)
TABLE 7.7 FIR filter length estimation using window functions (normalized transition width \( \Delta f = |f_{\text{top}} - f_{\text{pass}}|/f_s \).)

<table>
<thead>
<tr>
<th>Window Type</th>
<th>Window Function ( w(n) ), (-M \leq n \leq M)</th>
<th>Window Length, ( N )</th>
<th>Passband Ripple (dB)</th>
<th>Stopband Attenuation (dB)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rectangular</td>
<td>( 1 ) ( 0.5 - 0.5 \cos \left( \frac{\pi n}{2} \right) )</td>
<td>( N = 0.9/\Delta f )</td>
<td>0.7416</td>
<td>21</td>
</tr>
<tr>
<td>Hanning</td>
<td>( 0.54 - 0.46 \cos \left( \frac{\pi n}{2} \right) )</td>
<td>( N = 3.1/\Delta f )</td>
<td>0.0546</td>
<td>44</td>
</tr>
<tr>
<td>Hamming</td>
<td>( 0.42 + 0.5 \cos \left( \frac{\pi n}{2} \right) + 0.08 \cos \left( \frac{2\pi n}{3} \right) )</td>
<td>( N = 5.5/\Delta f )</td>
<td>0.0194</td>
<td>53</td>
</tr>
<tr>
<td>Blackman</td>
<td>( 0.42 + 0.5 \cos \left( \frac{\pi n}{2} \right) + 0.08 \cos \left( \frac{2\pi n}{3} \right) )</td>
<td>( N = 5.5/\Delta f )</td>
<td>0.0017</td>
<td>74</td>
</tr>
</tbody>
</table>

Z-TRANSFORM

\[
\begin{align*}
\alpha u(n) & \quad \frac{dz}{z - 1} \\
\alpha^nu(n) & \quad \frac{dz}{z - \alpha}
\end{align*}
\]

Convolution Theorem

\[
\sum_{k=0}^{\infty} x_1(k)x_2(n-k) \iff X_1(z)X_2(z)
\]

Bit index

\[
\begin{array}{cccc}
00 & x(0) = 1 & \text{FFT} & X(0) = 00 \\
01 & x(1) = 2 & & X(2) = 10 \\
10 & x(2) = 3 & W^1_4 = -1 & \text{Bit reversal} \\
11 & x(3) = 4 & W^0_4 = 1 & X(3) = 11 \\
\end{array}
\]

DFT

\[
W^k_N = e^{-j2\pi n/N} = \cos \left( \frac{2\pi n}{N} \right) - j \sin \left( \frac{2\pi n}{N} \right). 
\]

\[
X(k) = \sum_{n=0}^{N-1} x(n)e^{-j2\pi kn/N} = \sum_{n=0}^{N-1} x(n)W^k_N, \quad \text{for } k = 0, 1, \ldots, N-1.
\]
Q1 – List the key design issues of symmetric multiprocessor operating system. Explain two of them. [12 marks]

Q2 – The figure shown below is for single blocked queue. Redraw the figure for the following cases: (a) Multiple blocked queue. (b) Each process admitted to the system has a priority. [12 marks]

Q3 – Suppose that the processor has access to two levels of memory. Level 1 contains 1,000 bytes and has access time of 0.12 μs; level 2 contains 100,000 bytes and has an access time of 1.2 μs. Calculate the average time to access a byte for the following cases:
   (a) If 93% of the memory accesses are found in the cache.
   (b) If the Hit Ratio is 85%.
   (c) Discuss the results obtained in (a) and (b) using figure when necessary. (Note: Ignore the time required for the processor to determine whether the byte is in level 1 and level 2). [12 marks]

Q4 – Consider the following snapshot of a system:

<table>
<thead>
<tr>
<th></th>
<th>Allocated</th>
<th>Need</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>A B C</td>
<td>A B C</td>
</tr>
<tr>
<td>P0</td>
<td>3 0 1</td>
<td>1 1 0</td>
</tr>
<tr>
<td>P1</td>
<td>0 1 1</td>
<td>0 1 0</td>
</tr>
<tr>
<td>P2</td>
<td>1 1 1</td>
<td>3 1 0</td>
</tr>
<tr>
<td>P3</td>
<td>1 1 0</td>
<td>0 0 1</td>
</tr>
<tr>
<td>P4</td>
<td>0 0 0</td>
<td>2 1 0</td>
</tr>
</tbody>
</table>

(a) How many instances of each resource that exist in the system? (b) Find MAX. [12 marks]
Q5 - Given this deadlock Safety Algorithm:

1. Let Work and Finish be vectors of length $m$ and $n$ respectively. Initialize:

   \[
   \text{Work} = \text{Available}
   \]

   \[
   \text{Finish}[i] = \text{false} \text{ for } i = 0, 1, ..., n-1.
   \]

2. Find an index $i$ such that both
   a. $\text{Finish}[i] = \text{false}$
   b. $\text{Need}_i \leq \text{Work}$

   If no such $i$ exists, go to step 4.

3. $\text{work} = \text{Work} + \text{Allocation}_i$

   \[
   \text{Finish}[i] = \text{true}
   \]

   Go to step 2.

4. If $\text{Finish}[i] = \text{true}$ for all $i$, then the system is in a safe state.

Answer these questions:

(a) How many operations may this algorithm need to determine whether a state is safe?
(b) Discuss the values of vector Finish in 1, 2, 3 and 4 above.

[12 marks]

~~~~~~~~~ Good Luck ~~~~~~~~~~
1. 
A. Define the spatial locality in cache design.
B. Describe the address sequencing for the microprogramed control unit?
C. Briefly describe the mapping process from instruction opcode to the control memory address.

2. 
A. A computer architect needs to design the pipeline of a new microprocessor. Workload program core with $10^6$ instructions is used as example. Each instruction takes 100 ps to finish.
   (i) How long does it take to execute this program on a non-pipelined processor?
   (ii) The current state-of-the-art microprocessor has about 20 pipeline stages. Assume it is perfectly pipelined. How much speedup will it achieve over the non-pipelined processor?
B. Consider two different implementation, P1 and P2, of the same instruction set architecture. There are five classes of instructions (A, B, C, D and E) in the instruction set. The clock rate and CPI of each implementation are given in the following table.

<table>
<thead>
<tr>
<th></th>
<th>Clock Rate</th>
<th>CPI Class A</th>
<th>CPI Class B</th>
<th>CPI Class C</th>
<th>CPI Class D</th>
<th>CPI Class E</th>
</tr>
</thead>
<tbody>
<tr>
<td>P1 2.0 GHz</td>
<td>1</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>P2 3.0 GHz</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>3</td>
<td></td>
</tr>
</tbody>
</table>

(i) Given a program with instructions only of class A, which implementation is faster?
(ii) If the number of instructions executed in a certain program is divided equally among the classes of the instructions except for class E, which occurs twice as often as each of the others, which computer is faster? How much faster is it?

3. 
A. Compare between associative and direct mapped cache organization.
B. If two numbers on the bus A and B expressed in 2’s complement numbering system are compared by subtraction operation, i.e. $R[SA]-R[SB]$. The flag register bits $N$, $V$, $Z$ represent the negative, overflow and all 0’s state of the result, respectively. Pick the most appropriate answer for each of the following:
   (a) $A = B$, if (i) $Z=0$ (ii) $Z=1$ (iii) $Z \lor (N \oplus V)=1$ (iv) $(N \oplus V)=0$
   (b) $A \geq B$, if (i) $(N \oplus V)=0$ (ii) $(N \oplus V)=1$ (iii) $Z \lor (N \oplus V)=1$ (iv) $Z \lor (N \oplus V)=0$
C. Consider a machine with a byte addressable main memory of $2^{16}$ bytes and block size of 8 bytes. Assume that a direct mapped cache consisting of 32 lines is used with this machine.
   (i) How is a 16-bit memory address divided into tag, line number, and byte number?
   (ii) Into what line would bytes with each of the following addresses be stored?
       0001 0001 0001 1011
       1100 0011 0011 0100
       1101 0000 0001 1101
       1010 1010 1010 1010
   (iii) Suppose the byte with address 0001 1010 0001 1010 is stored in the cache. What are the addresses of the other bytes stored along with it?
   (iv) How many total bytes of memory can be stored in the cache?
   (v) Why the tag is also stored in the cache?
A. Give one advantage and one disadvantage for each ISA choice: RISC and CISC.

B. Consider the state machine diagram for the Shift Right Multiple (SRM) and Shift Left Multiple (SLM) instructions. These instructions are examples of extreme variability in execution time. 

Answer the following:
(i) What is the minimum number of clock cycles that are required to execute the instruction?
(ii) What is the maximum number of clock cycles that are required to execute the instruction?
Answer All questions

Each question carries 12 Marks

Q1) A) Write the correct answer for each of the following:

1. In a noisy environment, ...... is usually used.
   a. UTP       b. STP    c. Telephone line    d. RJ-45
2. ...... allows each station on Ethernet LAN to have the entire capacity of the network to itself.
   a. bridge  b. Router  c. Hub       d. switch
3. The minimum frame length for 10Mbps Ethernet is ......; the maximum is ...........
4. ...... is a 32 bit address. a. IPv4    b. IPv6  c. MAC    d. Port

5. Which application allowing the translate between names and IPs.
   a. Telnet  b. FTP  c. RPC  d. DNS
6. Which interface on the router provide physical connectivity for a configuration.
7. Data communication without error control is .........
8. The ...... sublayer is responsible for the operation of access control.
   a. LLC    b. MAC    c. Physical    d. Network
9. The connector for optical fiber medium is .........
   a. RJ-45    b. RJ-11    c. RG-75    d. SC
10. ...... runs only over optical fiber medium.
    a. 10BASE-T    b. 100BASE-T    c. Gigabit Ethernet    d. 10GbE

B) Fill in the blanks:

1. ...... is a dynamic mapping method that finds a physical address, given a logical address.
2. ...... refers to a set of procedures used to restrict the amount of data that the sender can send before waiting for acknowledgement.
3. The ...... addresses will change from hop to hop, but the ...... addresses usually remain the same.
4. Class ...... is used for multicast transmission.

C) Mention three types of unguided media. Explain one of them.

Q2) A) Encode the sequence 10011010 as: a. NRZ-I    b. AMI

B) Explain with diagram how selective-reject ARQ method can perform error control for lost data frame.

C) Complete the Table shown.

<table>
<thead>
<tr>
<th>Band</th>
<th>Freq. Range</th>
<th>Propagation type</th>
<th>Application</th>
</tr>
</thead>
<tbody>
<tr>
<td>VLF</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>LF</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>MF</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>HF</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>VHF</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>UHF</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SHF</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>EHF</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Q3) Given that an Ethernet LAN having: Network IP address 192.168.20.0, Ten computers, 8-port switch, Repeater, and a Server at far end (200m).

b. Assign an IP address for each host.
c. Assign an IP address for the default gateway.
d. If the LAN is connected to the Internet by a Router, What configuration is required for proper operation.
e. How many collision domains in the network.

B) Find the error, if any, in the following IP addresses.
   a. 111.56.045.78   b. 221.34.7.8.20   c. 75.45.301.14

C) What is the default mask IP address and for what purpose is it used?

Q4) Refer to the diagram in the figure below:

a. Mention and assign the type of each interface in the diagram.
b. How many networks can be in the diagram?
c. Assign IP address for each network.
d. Assign IP address for each host.
e. How many LANs and WANs in the diagram?
f. What is the default gateway IP address for each LAN.
g. The diagram represents Internet, internet, or internetwork?
h. How many collision domains and broadcast domains?
i. Mention the OSI layers related to the operation of the Router.
j. Why R1 is assigned as DCE?
k. Redraw the diagram if R2 is replaced by a switch.

Q5) A) Define the Ethernet technology. Mention all Ethernet categories. Explain one of them in detail.

B) ) Complete the table shown.

<table>
<thead>
<tr>
<th>Characteristic Technology</th>
<th>Standard Access Control</th>
<th>Topology</th>
<th>Applications</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ethernet</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Token Bus</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Token Ring</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>FDDI</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Q1)  
A. Design the hardware required to interface the 16550 UART at base address F301h. The frequency of the crystal is 18.432 MHz (that to be tied to the 16550 UART).  

B. Initialize the 16550 UART with the following configuration parameters: The baud rate is 9600, 8-bit data, one stop bit and even parity. \(X\) is a 16-bit array of size 1024 elements. Write a piece of code to send serially the \(X\) array.

Q2)  
A. Explain briefly the main differences between 8086 and 80386 microprocessors?  

B. Write an assembly program to Static test a 128 Kbyte of RAM which starts at address 80000h.

Q3) 8086 microprocessor is to be used in a dedicated controller application as shown in figure 1. Refer to figure 2:  
1. Write an assembly subroutine to initialize the PPI. Port-A is to be programmed to operate as strobed input with interrupt enable, while Port-B as basic output.  
2. Write an assembly subroutine to initialize the Timer. Counter-0 and Counter-1 are to be programmed to generate square waves with 5 KHz and 500 KHz respectively.  
3. Write an assembly subroutine to initialize the PIC. IRQ1 will generate interrupt number 71h.  
4. Write a piece of code to realize the digital filter. Use 5-bits fixed point arithmetic.

Q4)  
A. How the physical address of the 80386 microprocessor is computed in protected-mode with paging?  

B. Explain briefly the mechanism of interrupt operation in protected mode?

Q5)  
A. What is the result of the used registers after executing the following piece of code:  

\[
\begin{align*}
\text{MOV AX, 800Fh} \\
\text{MOVZX EAX, AX} \\
\text{BTR EAX, AL}
\end{align*}
\]

B. Counter 0 address of \(82C54\) is F030h while the address of control register is FC30h. Write a piece of code to program Counter 1 as the same as of Counter 2 with initial count of 5690h. Note: Counter 2 is previously programmed.
\[ H(z) = \frac{Y(z)}{X(z)} = \frac{1 + 0.235z^{-1} + 0.322z^{-2}}{1 + 0.141z^{-1} + 0.287z^{-2}} \]

Figure 1

Figure 2
Q1.
A. Draw the Integrator circuit then derive its mathematical equation.
B. Using OP AMP, Design the following mathematical equation:

\[ \text{output} = \int \ln x^2 \, dx + e^x \]

(15 Marks)

Q2.
A. Explain the advantage and disadvantage of Flash ADC.
B. Realize the following equation using OP amp.

\[ V_o = -4V_1 - 2V_2 + 10V_3 + V_4 \]

(15 Marks)

Q3: For the 8-bit Successive approximation ADC shown, if a DC input of 43V is applied to its Input. Find the sequence of binary states of SAR. Assuming that the DAC has the following characteristic:

(15 Marks)

<table>
<thead>
<tr>
<th>Binary</th>
<th>Voltage</th>
</tr>
</thead>
<tbody>
<tr>
<td>10000000</td>
<td>128V</td>
</tr>
<tr>
<td>01000000</td>
<td>64V</td>
</tr>
<tr>
<td>00100000</td>
<td>32V</td>
</tr>
<tr>
<td>00010000</td>
<td>16V</td>
</tr>
<tr>
<td>00001000</td>
<td>8V</td>
</tr>
<tr>
<td>00000100</td>
<td>4V</td>
</tr>
<tr>
<td>00000010</td>
<td>2V</td>
</tr>
<tr>
<td>00000001</td>
<td>1V</td>
</tr>
</tbody>
</table>
Q4: For the Inverter circuit shown below, assume \( V_{i} = 3 \) V, \( V_{BE_{sat}} = 0.8 \) V and \( V_{CE_{sat}} = 0.2 \) V. Determine the minimum value of \( \beta \) needed to make transistor saturated.

\[
\begin{align*}
\text{IN} & \quad 6 \text{ K} \\
\text{OUT} & \quad 1.5 \text{ K}
\end{align*}
\]

(15 Marks)

Q5: A 555 timer configured to run in the astable mode (oscillator) is shown in the figure below:

If the frequency of the output is 5.64 kHz and the duty cycle is 59.5\%, find: \( R_{1}, R_{2}, t_{h}, \) and \( t_{L}. \)

(15 Marks)

Good Luck
Note: Attempt all questions.

Part I: Electronics and Communication Lab.

Q1\ Implement the following logical expression using DTL logic. [3 Marks]

\[ Y = \overline{A} \overline{B} + \overline{C} \overline{D} \overline{E} + \overline{F} \]

Q2\ Regarding the following diagram, the Data Source is a bipolar square wave which has \( V_{pp} = 2 \) volts and the Carrier source is \( (\cos \omega t) \). What should the DC Voltage value be to obtain ASK modulated signal at point 4? Draw that ASK signal. [3 Marks]

Q3\ Choose the Correct Answer [4 Marks]

1. In phase modulation technique, what is the most efficient value of the phase difference from the point of noise immunity is
   a. 180
   b. 90
   c. 270

2. The symbol \( 74LSXX \). Indicate that the TTL type is:
   a. Low power TTLs with Schottky diode
   b. Low noise TTLs with Schottky diode
   c. Low noise TTLs.

3. The rate at which the signal is sampled regularly is called
   a. sampling rate
   b. bit rate
   c. resolution
4. If \( V_1 = 5 \text{ V} \) and \( V_2 = 3 \text{ V} \), \( V_o \) for the following circuit equals to?
   a. 8 Volts.
   b. -2 Volts.
   c. 2 Volts.

Part II: Computer Network Lab

Q1) Define **six** from the following:
   NOS, firewire, datagram, bootstrap program, Molex Connectors, ICMP, SCSI Ports, Form factor.

Q2) Which of the following sentences is correct? If not, rewrite or fill in the blanks to be correct. (Answer eight only).

1. In Windows XP, when simple file sharing is turned OFF, remote users always authenticate as the Guest account.
2. If a full IOS image cannot be located in the router flash memory, next step, a scaled-down version of the IOS is copied from ROM into RAM.
3. IP does its best to deliver a packet to its destination. But with no guarantees.
4. UTP T568A Standard uses wire (1, 2) for data sending and (3, 4) for receiving.
5. **Refers to the amount of force needed to install a CPU into the motherboard socket or slot.**
6. The IEEE 1394a standard supports data rates up to 400 Mbps.
7. WAN interface of the router could be used for initial configuration.
8. Factors to select media are: cost, data rate (bandwidth) and **_.**
9. When someone on the Internet or a network tries to connect to your computer, we call that attempt an **_** request.
10. USB 2.0 allows transmission speeds up to 580 Mbps.

Q3) For the figure below:

   a. Assign proper (IP address, subnet mask and gateway addresses) for the PCs and router.
   b. How many broadcast domain and collision domain in the figure?
Part III: DSP Lab

a- Write a MATLAB code to convert the following discrete time signal to its continues form.
\[ X_{\text{discrete}} = e^{-20jnTS} \]
Where the sampling frequency is 60 samples/sec. [2 Marks]

b- What are the differences between down sampling and decimation? Give an example for each of them. [1 Mark]

c- Design the digital Chebyshev-I highpass filter with the following specification using MATLAB.
wp = 0.7 π, ws = 0.4886 π, Rp = 1, and As = 20 [1 Mark]

d- Write MATLAB code to find the inverse z-transform of the following signal using the power series expansion method: [2 Marks]
\[ X(z) = \frac{1 + 5z^{-1} + 1.2z^{-2}}{4z^{-1} + 0.6z^{-2}} \]

e- Design LabVIEW VI to add echo effect to the wav file “wave.wav” found in the path: F:\tones . with the following specifications: Delay=0.2 sec, Gain=0.5. Then play the wav file with echo effect. [2 Marks]

f- You have the function ideal_lp on your work space, design a high pass FIR filter (using MATLAB codes) with the following specification: [2 Marks]
Stop band edge: 0.3π
Pass band edge: 0.52π
Attenuation in the stop region: 50 dB
Ripple in the pass region: 0.2 dB

<table>
<thead>
<tr>
<th>Window Name</th>
<th>Transition Width Δω</th>
<th>Min. Stopband Attenuation</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Approximate</td>
<td>Exact Values</td>
</tr>
<tr>
<td>Rectangular</td>
<td>4π</td>
<td>1.8π</td>
</tr>
<tr>
<td></td>
<td>M</td>
<td>M</td>
</tr>
<tr>
<td>Bartlett</td>
<td>8π</td>
<td>6.1π</td>
</tr>
<tr>
<td></td>
<td>M</td>
<td>M</td>
</tr>
<tr>
<td>Hanning</td>
<td>8π</td>
<td>6.2π</td>
</tr>
<tr>
<td></td>
<td>M</td>
<td>M</td>
</tr>
<tr>
<td>Hamming</td>
<td>8π</td>
<td>6.6π</td>
</tr>
<tr>
<td></td>
<td>M</td>
<td>M</td>
</tr>
<tr>
<td>Blackman</td>
<td>12π</td>
<td>11π</td>
</tr>
<tr>
<td></td>
<td>M</td>
<td>M</td>
</tr>
</tbody>
</table>

Table 1. Summary of commonly used window function characteristics
أ) ضع علامة (√) أمام العبارة الصحيحة وعلامة (X) أمام العبارة الخاطئة، ثم صحح الخطأ.
1. من مزايا التخطيط إنه يساعد على الكشف عن التغييرات المستقبلية.
2. المواد الثانوية لتقنية إيجاد الجودة تضم طلب الزوبو والميزانية التنافسية.
3. النتائج غير المباشرة للعمل بنظام السلامة المهنية يمثل في تقليل إصابات العمال والأمراض المهنية للعامل.
4. من المواد المؤثرة في ظهور سلسلة المواجهة 9000 هي الميزانية التنافسية.
5. تضمن المواد القارية للمدير هيئة المواجهة، بينما المواد التعليمية معالج الارتباطات.
6. من أساليب القيادة هي القيادة الفردية وهي أفضل أساليب.

(ب) اجب عن أحد الفرضيات الآتي:
1. وضع المهام الإدارية مع الرسم . 2. تكلفة وتوفير النتيجة والعمليات .

ب) تقي مسؤولية تنفيذ برنامج السلامة المهنية على كاهل كافة العاملين في المنظمة ووضع ذلك بالتفصيل .

س/2 (أ) تقي مسؤولية تنفيذ برنامج السلامة المهنية على كاهل كافة العاملين في المنظمة .

س/3 (أ) شركة إنجاز الماركات تنتج ثلاثة أنواع من العلب، إذا كانت كل علبة إنتاج العلبة الواحدة من العلب الأولى هي 100 دينار، ومن العلب الثانية 250 دينار، وسائل إنتاج العلبة الواحدة من العلب الثالثة هي 500 دينار، وكان إنتاج النوع الأول من العلب يحتاج إلى 3000 ساعة عمل 5000 وحدة من المواد الأولية و2000 دينار، والمنتج النوع الثاني يطلب توفير 2700 ساعة عمل 4500 وحدة من المواد الأولية و1500 دينار رأس مال، وكان إنتاج النوع الثالث يستغرق 3100 ساعة عمل، 5200 وحدة من المواد الأولية و2300 دينار رأس مال. إذا كان الحد الأدنى من ساعات العمل الكلي هي 6000 ساعة عمل ومن المواد الأولية هي 8000 وحدة والميزانية المخصصة للإنتاج هي 12000 دينار. المطلوب: كون نموذج البرمجة الخطية لإنتاج الماركات الثلاث.
(ب) عرف بحوث العمليات ومهم خيام شبكات الأعمال.

س/4 (أ) في هذا المشروع الصناعي كانت النشاطات موضحة بالجدول الآتي:

<table>
<thead>
<tr>
<th>النشاط السابق</th>
<th>النشاط التالي</th>
<th>الوقت التدريجي</th>
<th>الوقت الأقل احتمال</th>
<th>الوقت التشاوسي</th>
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<tbody>
<tr>
<td>A</td>
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<tr>
<td>B</td>
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<tr>
<td>H</td>
<td>F</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>I</td>
<td>J</td>
<td>0.7</td>
<td>1</td>
<td>1.3</td>
</tr>
</tbody>
</table>

المطلوب: 1. رسم المخطط الشبكي للمشروع . 2. تحديد الوقت المتوقع لإنجاز المشروع . 3. ايجاد الابحاث الحرج للمشروع . 4. ما هو احتمال إنهاء المشروع خلال 30 أسبوعًا .

مع تمنياتي بالوفقة والنجاح الدائم .
Q1) A- Evaluate the integral in polar coordinates: \[ \int_0^\infty \int_0^{\sqrt{r^2-y^2}} \cos(x^2 + y^2) \, dA \], where D is the region lies to the left of the y-axis within the circle \( x^2 + y^2 = 9 \). \[ 6 \text{ marks} \]

B- Solve \[ x(\ln y - \ln x) \, dy = y(1 + \ln y - \ln x) \, dx \]. \[ 6 \text{ marks} \]

Q2) Given \( A = \begin{bmatrix} 1 & 1 & 3 \\ 1 & 5 & 1 \\ 3 & 1 & 1 \end{bmatrix} \). Use the Eigen value method to compute \( A^5 = P \begin{bmatrix} \lambda_1^5 & 0 & 0 \\ 0 & \lambda_2^5 & 0 \\ 0 & 0 & \lambda_3^5 \end{bmatrix} P^{-1} \), where P is eigenvectors of the matrix. \[ 12 \text{ marks} \]

Q3) A- Use the method of variation of parameters to find a particular solution to the differential equation \( y'' - 4y' + 4y = (x+1)e^{2x} \). \[ 6 \text{ marks} \]

B- Integrate the function \( \int e^z \, dz \) around the circle \( |z-1|=1 \). \[ 6 \text{ marks} \]

Q4) A- Evaluate \( \int \frac{10}{\sqrt{x^3 + 8}} \, dx \). Using the Simpson’s Rule with 4 strips. \[ 6 \text{ marks} \]

B- Find an equation of the line through (-3,0,4) that is perpendicular to the plane \( 2x+y-z=0 \). \[ 6 \text{ marks} \]

Q5) A- Bits are sent over a communications channel in packets of 12. If the probability of a bit being corrupted over this channel is 0.1 and such errors are independent, what is the probability that

1- no more than 2 bits in a packet are corrupted?
2- more than 3 bits in a packet are corrupted?
3- Find the mean and variance of the number of bits in a packet are corrupted. \[ 8 \text{ marks} \]

B- Find a product solution of \( \frac{\partial^2 u}{\partial x^2} - u = 0 \). \[ 4 \text{ marks} \]

Good luck

Examiner: A. I. Abdullah
س 1
عرف خمسا من المصطلحات التالية:
- الدولة المركبة (الاتحادية)
- الحكومة المطلقة
- الحكومة الديكتاتورية
- الديمقراطية شبه المباشرة
- الاستفتاء الشعبي

(20 درجة)

س 2
اجب عن فرعين مما يأتي:
أ/ ما هي الحكومة القانونية وما هي خصائصها؟ (10 درجات)
ب/ ما هي أنواع النظام الرئاسي؟ (10 درجات)
ج/ تتميز الشؤون عن الديمقراطية اشرح ذلك؟ (10 درجات)

(20 درجات)

هناك أسباب للاتخاذ هي أسلوب الاقتراع المقيد وأسلوب الاقتراع العام تكلم عنها بالتفصيل؟

مع دعائنا لكم بالنجاح والموفقية

مدير المادة
محمد ظاهر قاسم الاوجار
Q1- Consider a continuous-time system which has input of signal \( x(t) \) and output of \( y(t) = x(t)u(t) \).
   a) Is this system time invariant? Justify your answer.
   b) Is this system linear? Justify your answer. (8)

Q2- Consider the signal \( g(t) \) shown:

   a) Sketch the derivative of \( g(t) \).
   b) Sketch the signal \( y(t) = g(4 - 2t) \). Show all the steps. (3+6)

Q3- Suppose \( x(t) = 2e^{-2t} u(t) \) and \( h(t) = e^{-4t} u(t) \).
Find the Fourier transform of the above signals and use your result to calculate a
time-domain expression for \( y(t) = x(t) \circ h(t) \). (10)

Q4- Find inverse Laplace transform of

\[
X(s) = \frac{(s + 2)}{[(s^2 + 3)(s - 1)]}
\]  

(8)
Q5- Complete the following MATLAB program that implements the signals shown below.

\[ t_1 = -15.5:0.01:-7; \]
\[ x_1 = 1.5 + (-4 \times \sin(\pi/15 \times t_1 - 25)); \]

Q6- A- What is the differential equation from the following system

B- Sketch the result of the following commands.

\[ >> n = 0:5; x = 2 \times n + 1; \text{stem}(n,x); \text{grid} \text{ on} \]

Q7- Given the following array \( A = [16 \ 2 \ 3 \ 13; 5 \ 11 \ 10 \ 8; 9 \ 7 \ 6 \ 12; 4 \ 14 \ 15 \ 1] \)

What are the results of the following commands.

1- \[ >> N = \text{blkdiag}(3 \times \text{ones}(2,2),\text{ones}(3,2)) \]
2- \[ >> [\text{sum}(a)' \ \text{eye}(3)] \]
3- \[ >> z=2; D= \text{diag}(-z:z) \]
4- \[ >> A(\text{end},:) \]
ANSWER ALL QUESTIONS

Q1)  
A. What are the contents of the memory after execution the following piece of code:

```
std
mov ax, 8000h
mov es, ax
not ax
mov cx, 5
mov di, 2009h
rep stosw
```

<table>
<thead>
<tr>
<th>Address</th>
<th>Content</th>
</tr>
</thead>
<tbody>
<tr>
<td>82000h</td>
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<tr>
<td>82009h</td>
<td>01h</td>
</tr>
<tr>
<td>8200ah</td>
<td>00h</td>
</tr>
</tbody>
</table>

[5 Marks]

B. is a 32-bit signed array of size 1024 elements. Write a piece of code to sort the array in descending order.

[5 Marks]

Q2)  
A. X is a square matrix of size 32 x 32 (8-bit signed integer) stored in computer memory as row major. Write a piece of code to compute the transpose of X matrix.

\[ \mathbf{X} = \mathbf{X}^T \]

[6 Marks]

B. Write a piece of code to add two 64-bit unsigned integers (X and Y) and store the result in Z (64-bit unsigned integer). Given the following declaration:

<table>
<thead>
<tr>
<th>X</th>
<th>Y</th>
<th>Z</th>
</tr>
</thead>
<tbody>
<tr>
<td>DQ</td>
<td>DQ</td>
<td>DQ</td>
</tr>
</tbody>
</table>

; X is 64 bit unsigned integer
; Y is 64 bit unsigned integer
; Z is 64 bit unsigned integer

[4 Marks]
Q3) Write a piece of code to compute:

\[ Y(n) = X(n) + 0.75 \times X(n-3) - 0.915 \times Y(n-3) \]

Where:

\( n = 0, 1, 2, \ldots, 1023 \)

\[ X : \text{is a 16-bit signed integer array of size 1024.} \]

\[ Y : \text{is a 16-bit signed integer array of size 1024.} \]

**Note:** \( X(-1), X(-2), X(-3), Y(-1), Y(-2) \), and \( Y(-3) \) are zeros. Use fixed point arithmetic with 5-bit fraction.

Q4)

Design the hardware required for interfacing the 8086 demultiplexed buses to the following system memory:

1. 64 Kbyte of ROM using 32 Kx8 ROM chips starting at address F0000h.
2. 128 Kbyte of SRAM using 16 Kx8 SRAM chips starting at address 00000h.

Q5)

A. Write an assembly subroutine to print the value of BX register in hexadecimal. Use the following declaration:

\[
\text{PrintHex} \quad \text{PROC} \\
\text{PrintHex} \quad \text{ENDP}
\]

B. Write an assembly subroutine that generates 200msec time delay. Given the following: 8086 speed is 5MHz, call 19H, ret 16H, movreg, data 4H, push reg 11H, pop reg 8H, loop 17/5 H.
ANSWER ALL QUESTIONS

Q1)

A. What are the contents of the memory after execution the following piece of code:

```assembly
std
mov ax, 8000h
mov es, ax
not ax
mov cx, 5
mov di, 2009h
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```

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[B. is a 32-bit signed array of size 1024 elements. Write a piece of code to sort the array in descending order.]

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Q2)

A. X is a square matrix of size 32 X 32 (8-bit signed integer) stored in computer memory as row major. Write a piece of code to compute the transpose of X matrix.

\[ X = X^T \]

[6 Marks]

B. Write a piece of code to add two 64-bit unsigned integers (X and Y) and store the result in Z (64-bit unsigned integer). Given the following declaration:

```
X DQ ?   ; X is 64 bit unsigned integer
Y DQ ?   ; Y is 64 bit unsigned integer
Z DQ ?   ; Z is 64 bit unsigned integer
```

[4 Marks]
Q3) Write a piece of code to compute:

\[ Y(n) = X(n) + 0.75 \times X(n-3) - 0.915 \times Y(n-3) \]

Where:
\[ n = 0, 1, 2, \ldots, 1023 \]

\( X \): is a 16-bit signed integer array of size 1024.
\( Y \): is a 16-bit signed integer array of size 1024.

**Note:** \( X(-1), X(-2), X(-3), Y(-1), Y(-2), Y(-3) \) are zeros. Use fixed point arithmetic with 5-bit fraction.

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Design the hardware required for interfacing the 8086 demultiplexed buses to the following system memory:
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A. Write an assembly subroutine to print the value of BX register in hexadecimal. Use the following declaration:

```assembly
PrintHex PROC

PrintHex ENDP
```

B. Write an assembly subroutine that generates 200msec time delay.
**Given the following:** 8086 speed is 5MHz, call 19T, ret 16T, movreg, data 4T, push reg 11T, pop reg 8T, loop 17/5T.
 Attempt All questions

Q1- Consider a signal with amplitude pdf given by \( p(x) = k(1 + |x|^{1/2}) \), for \(-1 < x < 1\).
   a- Determine the value of \( k \).
   b- Determine mean, standard deviation, and power of the signal.
   c- If the signal is quantized with uniform quantizer with 256 levels, what is the output S/N for the sampled signal?
   d- If the bandwidth of the signal is 3 KHz, what is the bit rate of the corresponding PCM signal?

(20)

Q2- Given the sequence \( S = \{1,1,1,0,1,0,1,0,1,0,0,0,0,0\} \) generated by delta modulation draw the demodulator output.

(10)

Q3- Consider a discrete memory-less source with following symbol probabilities
   \( p(x_1) = 0.3, p(x_2) = 0.25, p(x_3) = 0.2, p(x_4) = 0.15, p(x_5) = 0.1 \),
   a- What is the entropy of the source?
   b- What is the average word length if the source is encoded with natural encoder (fixed-length)?
   c- Develop a Huffman encoder for the DMS.
   d- Calculate the average code word length for the Huffman encoder.

(15)

Q4- Answer the followings briefly
   a- Write short note on QPSK.
   b- Explain use of TDM in PCM
   c- Define Parity & Parity check code.

(15)
Q1: (12 Marks)
Design use PLA to convert BCD to 2421 Code.

Note: use don't care to the element of unused code

Q2: (12 Marks)
The time diagram shown below:
Label each state and write a composite flow map, reduce number of states if possible and making Race-Free state assignments.
Design use JK Flip Flops

Q3: (12 Marks)
The function: 
\[ f(A,B,C,D,E) = \sum m(0,5,11,12,14,20,21,25,27,28,30,31) + d(7,13,22,23) \]
a- Minimize using Quine-McCluskey method.
b- Implement the function with hazard free use NAND gates only, and design with the following signal: Signal list: \( \neg F, A[NL], \neg B, C, \neg D[NL], \neg E \)

Q4: (12 Marks)
The function \( f(A,B,C,D,E) = \sum m(0,1,3,6,8,11,12,13) + d(5,9) \)
a- Design use 4 input multiplexer when \( C, \) and \( D \) are partitioned variables
b- Implement with minimal logic gates use Map entered variable method when \( C, \) and \( D \) are Map variable

Q5: (12 Marks)
The state table of synchronous sequential system shown:
Draw the state diagram, ASM, and design use T-Flip Flops
س 1) بالنسبة للمدينة في الشكل أوجد ما يلي:

1 - كسب الفولتاية الإجمالي عند تردد القطع.
2 - كسب الفولتاية الإجمالي عند التردد 10Hz

علما أن:
C1 = 10 μF
C2 = 1 μF

س 2) في الشكل المعين... جد قيمة المقاومة R1 إذا علمت أن:

( IDSS = 25mA, Vp = -10V, VDS = 7V, β = 100 )
للدائرة المبينة في الشكل أدناه، إذا علِمت أن:

- $RL = 500\,\Omega$, $Rs = 440\,\Omega$
- $rbb = 100\,\Omega$, $rbe = 1\,K\Omega$
- $hfe = 100$, $gm = 100\,mA/V$
- $f_r = 400\,MHz$, $Cc = 1\,pF$

أوجد كسب الفولتية الإجمالي عند التردد $15\,MHz$.

(12 درجة)

(4 درجات)

(8 درجات)

เซ (4) في الشكل المبين، جد ما يلي:
1. كسب الفولتية الإجمالي عند التردد 8Hz.
2. عامل الاستقرار $S_{ICE}$.

(8 درجات)

ideal differentiator

(4 درجات)

إذا علِمت أن كسب الفولتية عند التردد 50Hz لموجة إدخال جيبية في دائرة بسامي (2) كم سيكون الكسب عند التردد 1KHz؟

(8 درجات)

إرسم شكل فولتية الإخراج للدائرة المبينة إذا علِمت أن: $V1 = 0.25\sin wt$, $V2 = 10V$ و $V2 = 10V$.

(8 درجات)

تمثيلي بالنجاح
Q1: A patient has to be monitored for 24 hours in the Intensive Care Unit (ICU) in the General Hospital in Mosul. A nurse has to check and record the patient’s temperature every hour. The nurse also has to write a report next day to the patient’s doctor; this report has to have all the records when the patient’s temperature is over 39°C or less than 35°C. Write C++ program to enter the patient’s records then create a linked list that covers the given information above. Finally add the node A at the beginning of your list.

```cpp
struct Patient{
    int Temp;
    int Hour;
    Patient *Next;
};
```

Q2: Create a class called Rational for performing arithmetic with fractions. Use integer variables to represent the private data of the class (the numerator and the denominator). Provide a constructor that enables an object of this class to be initialized when it’s declared. The constructor should contain default values in case no initializers are provided which is \( \frac{1}{4} \) (1 is the numerator and 4 is the denominator).

Provide public methods that perform each of the following tasks:

a. Printing Rational numbers (printr). When the input of this function is 0, the function should print the numbers in rational format \( \frac{\text{num}}{\text{den}} \). Otherwise the function will print the numbers in floating-point format.

b. The operator + for adding two Rational numbers. This function has to be friend.

c. The operator / for dividing two Rational numbers. This function has to be friend.

Test these functions in the main program.
Q3: Write C++ header file for a **Queue class** to be used for **dynamic storage of float data** of maximum 1000 values. Beside the class **constructor** and **destructor**, it should have the following methods:

- **Push** to store a float value in the top of the Queue (FIFO).
- **Pop** to read a float value from the bottom of the Queue (FIFO).
- **Popt** to read a float value from the top of the Queue (FILO).

Friend function called "**Join**" to join two Queues.

In a main program, show how you can use this class to create **two objects** and **store 5 values** in each of them. Then **Join** the two objects to each other and print the result on the screen. Test the **Popt** function by reading the last value of the joined Queue.

[10 marks]

Q4: What is the execution result of running the following C++ program? Comment on your result.

```c
#include<stdio.h>
define max 20
char stack[max];
int index=-1;
int push(char n){
  if (index==max-1) return(-1);
  stack[++index]=n;
  return(1);
}
char *pop(){
  if(index==-1) return(NULL);
  return &stack[index--];
}
void main()
char a[20]={'a','g','b','n','c','a','d','l','z','r','y','e','x','v','w','e','v','l','u','c'};
  for(int i=1;i<20;i+=2) push(a[i]);
for (i=0;i<12;i++)
  char *a=pop();
  if (a==NULL) printf("nUnder Flow");
  if(i==6) printf("t");
  printf("%c",*a);
}
```

[10 marks]
Q5: Write C++ program that can read the General Directorate of Traffic database “Licence.bin”. Then sort this database alphabetically descending according to the driver's name by using the quick sorting algorithm. Then find the index of a license number 12345. Finally store your result in a text file called “result.txt”.

```
struct Car{
    char *Driver;
    char *Type;
    unsigned int Number;
    unsigned int Licence;
};
```

[10 marks]

~ With my best wishes ~
ATEEMPT ALL QUESTIONS

Electronics Lab

Q1) Choose the correct answer: [7 Marks]

1. \( I_C \) of the transistor is
   a) \( I_C = \beta I_B \)
   b) \( I_C = (1+\beta) I_B \)
   c) \( I_C = I_C + I_B \)

2. Which one of the following items is represented by \( \beta \)?
   a) Current gain factor.
   b) Voltage gain factor.
   c) Power gain factor.

3. If base-emitter junction is open in common collector, the collector voltage is:
   a) \( V_{CC} \)
   b) 0V
   c) Floating

4. The JFET is called a voltage control device because
   a) It works depends on \( V_{gs} \)
   b) It works depends on \( I_D \)
   c) It works depends on \( V_{DS} \)

5. In a certain self-biased n-channel JFET circuit, \( I_D = 2mA \) and \( R_S = 2K\Omega \), \( V_{GS} \) equals to:
   a) 4 V.
   b) -4 V.
   c) 0 V.

6. The most widely used coupling type for transistor amplifier is
   a) Direct coupling.
   b) RC coupling
   c) Transformer coupling.

7. The most important application for Darlington configuration when the input current is very small is:
   a) Driver in the interface circuit
   b) Voltage amplifier
   c) Invertor
Q2)

A. What are the disadvantages of relays? [2 Marks]

B. Draw JFET Transfer Characteristic Curve [2 Marks]

Q3) State four differences between bipolar and unipolar transistors? [4 Marks]
**Logic Lab.**

**Q4)** Use the **7489 IC (16 × 4)** memory with suitable logic components to construct a **(64 × 4)** memory, draw the logic circuit. [7 Marks]

**Q5)** [8 Marks]

A. Write a complete VHDL program to implement the **BCD Adder circuit** shown in the figure below:

![BCD Adder Circuit Diagram](image)

B. Read the following VHDL code, then specify if the following codes are legal or illegal and if not, illustrate the reason.

```vhdl
library IEEE;
use IEEE.STD_LOGIC_1164.ALL;
use IEEE.STD_LOGIC_ARITH.ALL;

entity examtest is
  Port (x : in STD_LOGIC;
        y : in STD_LOGIC_VECTOR (3 downto 0);
        Resultl : in STD_LOGIC;
        Count : out STD_LOGIC);
end examtest;
```

...
Result2 : out STD_LOGIC_VECTOR (3 downto 0));

end examtest;

architecture Behavioral of examtest is

Signal A: STD_LOGIC_VECTOR (3 downto 0);
Signal B: STD_LOGIC;
Signal C: BIT_VECTOR(4 downto 0);
Signal D: BIT;
Signal k,m: STD_LOGIC_VECTOR (3 downto 0);
Signal S1,S2,S3: Unsigned(3 downto 0);
Signal i,j: integer range -8 to 7;

Begin

1. A(0)<=x;
2. B<=A(0);
3. C<=D(3);

end Behavioral;

Good Luck
Question 1 // (15 points)

Given the following Standing wave patterns of the resultant voltage for unknown load impedance \((Z_l)\) connected at the receiving end of the T.L. of a characteristic impedance \((Z_0 = 50 \Omega)\); determine:
- The standing wave ratio - VSWR \((S)\);
- The reflection coefficient factor at the receiving end;
- The maximum input impedance at maximum voltage point;
- The minimum input impedance at minimum voltage point;
- The power of the traveling voltage along the line;
- The wave length \((\lambda)\) and the frequency of the traveling voltage through the T.L.

---

Question 2 // (15 points)

Given that, for AM – DSB wave, the noise components \(n(t)\) is approximately equal to:
\[
n(t) = \sum_{k=1}^{\infty} 2 \Delta n \cos\left[2\pi\left(f_c + f_m + \frac{2k-1}{2} \Delta f \right)t\right]
\]

Where: 
- \(k = 1; 1.5; 2; 2.5; \ldots; 2f_m/\Delta f\).

Prove that the Signal to Noise Power Ratio at the detector input is given by:
\[
\frac{S_i}{N_i} = \frac{E_m^2}{16 \cdot f_m \cdot n_d}
\]

Question 3 // (15 points)

The output voltage of a transmitter is given by the following envelope wave form. This voltage is fed to a load \((1 \Omega)\). Find which type of modulation is this; also find:
The carrier frequency \(f_c\); The modulating frequency \(f_m\); The double sideband frequencies; The modulation index; the carrier signal voltage; The modulating signal voltage; the carrier power; the total power; and write down the modulated voltage wave equation at the output of the transmitter.
Question 4 // (15 points)

The Frequency Sensitivity of a Frequency Modulated Wave voltage is \( k_f = 500 \text{ Hz/volt} \); Given that the modulating signal is \( m(t) = 4 \cos(2\pi 10^2 t) \); and the carrier signal is:
\[
C(t) = 8 \cos(2\pi 10^5 t)
\]

- Find The Modulation index \( m_f \);
- Find The required Bandwidth;
- Find The maximum frequency deviation of this Modulated Wave \( \Delta f \);
- Find The total power delivered to the \( 2 \Omega \) resistive load;
- Find The carrier power delivered to the \( 2 \Omega \) resistive load;
- Write down The instantaneous phase angle equation \( \Theta(t) \) of this Modulated Wave;
- Write down The instantaneous frequency equation \( f_i(t) \) of this Modulated Wave; and
- Write down the Frequency Modulated Wave voltage equation in terms of Bessel function of the first kind, using the given table.

<table>
<thead>
<tr>
<th>( m_f )</th>
<th>( J_0(m_f) )</th>
<th>( J_1(m_f) )</th>
<th>( J_2(m_f) )</th>
<th>( J_3(m_f) )</th>
<th>( J_4(m_f) )</th>
<th>( J_5(m_f) )</th>
<th>( J_6(m_f) )</th>
<th>( J_7(m_f) )</th>
<th>( J_8(m_f) )</th>
<th>( J_9(m_f) )</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.00</td>
<td>1.00</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>0.25</td>
<td>0.98</td>
<td>0.12</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
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<td>0.50</td>
<td>0.94</td>
<td>0.24</td>
<td>0.03</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1.00</td>
<td>0.77</td>
<td>0.44</td>
<td>0.11</td>
<td>0.02</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1.50</td>
<td>0.51</td>
<td>0.36</td>
<td>0.23</td>
<td>0.06</td>
<td>0.01</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2.00</td>
<td>0.22</td>
<td>0.58</td>
<td>0.35</td>
<td>0.13</td>
<td>0.03</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2.50</td>
<td>-0.05</td>
<td>0.50</td>
<td>0.45</td>
<td>0.22</td>
<td>0.07</td>
<td>0.02</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3.00</td>
<td>-0.26</td>
<td>0.34</td>
<td>0.49</td>
<td>0.31</td>
<td>0.13</td>
<td>0.04</td>
<td>0.01</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4.00</td>
<td>-0.40</td>
<td>-0.07</td>
<td>0.36</td>
<td>0.43</td>
<td>0.28</td>
<td>0.13</td>
<td>0.05</td>
<td>0.02</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5.00</td>
<td>-0.18</td>
<td>-0.33</td>
<td>0.05</td>
<td>0.36</td>
<td>0.39</td>
<td>0.26</td>
<td>0.13</td>
<td>0.05</td>
<td>0.02</td>
<td></td>
</tr>
</tbody>
</table>

Question 5 // (15 points)

A loss-less Transmission Line shown in figure below, has distributed inductance of \( 12.5 \text{ [ } \mu \text{H/m} \text{]} \) and distributed capacitance of \( 5 \text{ [ nF/m] } \) and operates at a frequency of \( 20 \text{ MHz} \). Determine:
- The characteristic impedance \( Z_0 \);
- The Propagation constants \( (\gamma) \);
- The Phase constants \( (\beta) \);
- The velocity of Propagation \( (v_p) \);
- The reflection coefficient factor \( (k_r) \) at the receiving end;
- The VSWR of the line \( (S) \);
- The input impedance at the sending end \( (Z_m) \);
- The reflection coefficient factor at the sending end \( (K_S = ?/\gamma) \);
- How-far is the first minimum voltage point from \( Z_R \);

\[
\begin{align*}
E & \equiv \text{volts} \\
Z_0 & \equiv \gamma \\
Z_R & \equiv (50 + j 50) \\
\ell & = 1.375 \lambda
\end{align*}
\]
Q1) [10 marks]
Find the solution of the following system of linear equations by row operations:
\[ x + y - z = 9, \quad 8y + 6z = -6, \quad -2x + 4y - 6z = 40. \]

Q2) [10 marks]
Show that the tangents to the curve \( y = (\pi \sin x)/x \) at \( x = \pi \) and \( x = -\pi \) intersect at right angle.

Q3) [10 marks]
Sketch the curve \( y = 0.5 \cosh 2x, \quad 0 \leq x \leq \ln \sqrt{5} \), then find:
I) The length of this curve.
II) The area of the surface generated by rotating this curve about the x-axis.

Q4) [10 marks]
Find the length of the spiral \( r = \theta^2, \quad 0 \leq \theta \leq \sqrt{5} \). Sketch?

Q5) [10 marks]
Write out the fifth partial sum of the series \( \sum_{n=1}^{\infty} \left( \frac{1}{\ln(n+2)} - \frac{1}{\ln(n+1)} \right) \), then find the sum of it.

Q6) [10 marks]
The derivative of the function \( f(x, y) \) at \( P_0(1, 2) \) in the direction toward \( P_1(2, 2) \) is \( (2) \), and in the direction toward \( P_2(1, 1) \) is \((-2)\). Find \( \nabla f \) at \( P_0 \) and the derivative of \( f(x, y) \) at \( P_0(1, 2) \) in the direction toward \( P_3(4, 6) \).
Q1 Consider the image segment shown.

(a) Let \( V = \{0, 1\} \) compute the lengths of the shortest 4-, 8-, and m-path between \( p \) and \( q \). If a particular path does not exist between these two points, explain why. (4.5 marks)

\[
\begin{array}{cccc}
3 & 1 & 2 & 1 \\
2 & 2 & 0 & 2 \\
1 & 2 & 1 & 1 \\
1 & P & 0 & 1 & 2 \\
\end{array}
\]

(b) Give the condition(s) under which the \( D_4 \) distance between two points \( p \) and \( q \) is equal to the shortest 4-path between these points. (2.5 marks)

Q2

A. What effect would set to zero the bits planes (7, 6) at the same time, on the histogram of an image in general? (2 marks)

B. Explain why the discrete histogram equalization technique does not, in general, yield a flat histogram. (2 marks)

C. How the “Gaussian” noise look like? How can be removed? (3 marks)

D. In a given application an averaging mask is applied to input images to reduce noise, and then a Laplacian mask is applied to enhance small details. Would the result be the same if the order of these operations were reversed? (2 marks)

E. Discuss how can I get a sharpened image edges and fine detail are much more obvious, with example? (3 marks)

Q3 (A) Images shown below have size 70 x 30 pixels, with black (0) and white (1). Each white box in the image is 10 * 10 pixels, and the distance between them is 2 pixels. What would this image look like after application of?

- A 5 x 5 arithmetic main filter? (6 marks)
- A 5 x 5 max filter?
- A 5 x 5 min filter?
- A 5 x 5 midpoint filter?

Note: answer three only.

Q3 (B) Discuss the limiting effect of repeatedly applying a 3*3 low pass spatial filter to a digital image. You may ignore border effects. (2 marks)

Q3 (C) For the image segment shown what this image suffers from, and how it can be treated. (2 marks)
Q4 The diagram at the right contains several curves that could be used to transform the brightness values of a monochrome image by the operation $B = T[A]$ where $A$ and $B$ are image arrays. Shown below are four pairs of histograms. Identify the transformation curve(s) best associated with each pair and write the letter(s) in the space in the center column. **(6 marks)**

<table>
<thead>
<tr>
<th>Input image histogram</th>
<th>Transform</th>
<th>Output image histogram</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="" alt="Histogram 1" /></td>
<td><img src="" alt="Curve A" /></td>
<td><img src="" alt="Histogram 1" /></td>
</tr>
<tr>
<td><img src="" alt="Histogram 2" /></td>
<td><img src="" alt="Curve B" /></td>
<td><img src="" alt="Histogram 2" /></td>
</tr>
<tr>
<td><img src="" alt="Histogram 3" /></td>
<td><img src="" alt="Curve C" /></td>
<td><img src="" alt="Histogram 3" /></td>
</tr>
<tr>
<td><img src="" alt="Histogram 4" /></td>
<td><img src="" alt="Curve D" /></td>
<td><img src="" alt="Histogram 4" /></td>
</tr>
</tbody>
</table>

---

**Practical 15 marks**

Q1- Write a Matlab **function** that implements the following transformations Power and Lin. The class of the output image must be matched to the class of the input. **(4 marks)**

```matlab
function g=Tran(f,........)
```

Q2- Write a Matlab **function** that performs image spatial filtering, the function must take the image that we want to filter it and the mask and return a filtered image. **(4 marks)**

Q3- Write a Matlab **function** that implements the following filters GLPF, IHPF, QLPF and IBPF. The class of the output image must be matched to the class of the input. **(7 marks)**

```matlab
function g=Filt(f,........)
```
Q1) [10 marks]
Find the solution of the following system of linear equations by row operations:
\[
\begin{align*}
    x + y - z &= 9, \\
    8y + 6z &= -6, \\
    -2x + 4y - 6z &= 40.
\end{align*}
\]

Q2) [10 marks]
Show that the tangents to the curve \( y = \frac{\pi \sin x}{x} \) at \( x = \pi \) and \( x = -\pi \) intersect at right angle.

Q3) [10 marks]
Sketch the curve \( y = 0.5 \cosh 2x \), \( 0 \leq x \leq \ln \sqrt{5} \), then find:
I) The length of this curve.
II) The area of the surface generated by rotating this curve about the x-axis.

Q4) [10 marks]
Find the length of the spiral \( r = \theta^2 \), \( 0 \leq \theta \leq \sqrt{5} \). Sketch?

Q5) [10 marks]
Write out the fifth partial sum of the series \( \sum_{n=1}^{\infty} \left( \frac{1}{\ln(n+2)} - \frac{1}{\ln(n+1)} \right) \), then find the sum of it.

Q6) [10 marks]
The derivative of the function \( f(x, y) \) at \( P_0(1, 2) \) in the direction toward \( P_1(2, 2) \) is \( 2 \), and in the direction toward \( P_2(1, 1) \) is \( -2 \). Find \( \nabla f \) at \( P_0 \) and the derivative of \( f(x, y) \) at \( P_0(1, 2) \) in the direction toward \( P_3(4, 6) \).
Q1 - In developing software project, what are the risks of frequent change in project requirements? Discuss in your own words. 

[12 marks]

Q2 - Why and when company managers think to use agile process? What are the principles for those who want to achieve agility?

[12 marks]

Q3 - Every organization should strive to achieve the intent of the CMMI. What is CMMI? What should the organization do to achieve CMMI level-4?

[12 marks]

Q4 - A graph showing membership functions for fuzzy sets “short”, “medium” and “tall”.

Fill the table with membership values:

<table>
<thead>
<tr>
<th>Height in cm</th>
<th>Membership value</th>
</tr>
</thead>
<tbody>
<tr>
<td>120</td>
<td></td>
</tr>
<tr>
<td>160</td>
<td></td>
</tr>
<tr>
<td>180</td>
<td></td>
</tr>
<tr>
<td>195</td>
<td></td>
</tr>
<tr>
<td>210</td>
<td></td>
</tr>
</tbody>
</table>

[8 marks]
Q5 – (a) Use \( F(x; y) \) and \( M(x; y) \) to denote, respectively, '\( x \) is \( y \)'s father', and '\( x \) is \( y \)'s mother'. Write sentence of predicate logic using expressing the following statement: "Whoever has a mother has a father" [4 marks]

(b) Convert the following English into propositional logic:
   \[ A = \{ \text{If I am clever then I will pass}, \]
   \[ \text{If I will pass then I am clever}, \]
   \[ \text{Either I am clever or I will pass} \}
   \[ C = \text{I am clever and I will pass} \]
(c) Draw the truth table for part (b) [4 marks]

Q6 – (a) Consider two off-springs are selected for mutation, off-spring 1 at gene 6, and off-spring 2 at genes 6 and 11. What are the mutated off-springs produced?

\[
\begin{array}{c|c}
\text{Original off-spring 1} & 1101111000011110 \\
\text{Original off-spring 2} & 1101100100110110 \\
\end{array}
\]
[4 marks]

(b) Consider two parents are selected for two-point crossover at genes 4 and 11:

\[
\begin{array}{c|c}
\text{Parent 1} & 1101111000011110 \\
\text{Parent 2} & 1101100100110110 \\
\end{array}
\]
[4 marks]

~~GOOD LUCK~~
1. Answer three of the following:

(A) Draw the circuit diagram for the floating voltage to current converter.

(B) What are the distinguishing characteristics of soft and hard real time systems? Give examples.

(C) Give brief description for the release time jitter of periodic tasks.

(D) Describe the effect of ground loop noise? How the ground loop noise can be eliminated?

(12 Marks)

2. (A) A real-time system consists of three tasks T1, T2, and T3. Their characteristics have been shown in the following table. Suppose the tasks are to be scheduled using a table-driven (cyclic) scheduler.

<table>
<thead>
<tr>
<th>Task</th>
<th>Phase (ms)</th>
<th>Execution time (ms)</th>
<th>Relative deadline (ms)</th>
<th>Period (ms)</th>
</tr>
</thead>
<tbody>
<tr>
<td>T1</td>
<td>20</td>
<td>10</td>
<td>20</td>
<td>20</td>
</tr>
<tr>
<td>T2</td>
<td>40</td>
<td>10</td>
<td>50</td>
<td>50</td>
</tr>
<tr>
<td>T3</td>
<td>70</td>
<td>20</td>
<td>80</td>
<td>80</td>
</tr>
</tbody>
</table>

Explain and compute the length of time for which the schedules have to be stored in the precomputed schedule table of the scheduler.

(B) Consider the following system of periodic tasks:

T1=(100, 20), T2=(150, 50), and T3=(250, 100)

Construct the initial segments in the time interval (0, 750) of Rate-Monotonic (RM) schedule.

(14 Marks)

3. (A) Show that the output voltage of the instrumentation amplifier is given by

\[ v_o = (v_{i2} - v_{i1}) \left(1 + \frac{2R_1}{R_2} \right) \frac{R_4}{R_3} \]

(B) Write the expression for electrical-loading nonlinearity error (percentage) in a rotatory potentiometer in terms of the angular displacement, maximum displacement, potentiometer element resistance, and load resistance. Plot the percentage error as a function of the fractional displacement for the three cases RL/Rc = 0.1, 1.0, and 10.0.

(14 Marks)
4. Chose the correct choice

1. The content of the accumulator after these operations
   \[
   \begin{align*}
   &\text{MOV A,}#0BH \\
   &\text{ANL A,}#2CH
   \end{align*}
   \]
   will be
   \[
   \begin{array}{ll}
   \text{A.} & 11010111 \\
   \text{B.} & 11011010 \\
   \text{C.} & 00001000 \\
   \text{D.} & 00101000
   \end{array}
   \]

2. Data transfer from I/O to external data memory can only be done with the MOV command.
   \[
   \begin{array}{ll}
   \text{A.} & \text{True} \\
   \text{B.} & \text{False}
   \end{array}
   \]

3. The number of data registers is:
   \[
   \begin{array}{ll}
   \text{A.} & 8 \\
   \text{B.} & 16 \\
   \text{C.} & 32 \\
   \text{D.} & 64
   \end{array}
   \]

4. The I/O port that does not have a dual-purpose role is:
   \[
   \begin{array}{ll}
   \text{A.} & \text{Port 0} \\
   \text{B.} & \text{Port 1} \\
   \text{C.} & \text{Port 2} \\
   \text{D.} & \text{Port 3}
   \end{array}
   \]

B. Simple 8-bit analog-to-digital converter device, as shown below, is to be interfaced to an 8051 Microcontroller. The READY line goes low when conversion data is available. Also, the READY line should be used to interrupt the 8051 microcontroller.

(i) With the aid of a block diagram show how this device can be interfaced to the 8051.
    \[
    \begin{array}{c}
    \text{Vin} \\
    \text{A/D Converter} \\
    \text{Ready} \\
    \text{8-bit digital data}
    \end{array}
    \]

(ii) Write an assembly language program which will capture 250 data samples from the A/D converter and store this data in XDATA memory. The program is to be interrupt driven.

5. Write a program using interrupts to simultaneously create 7 kHz and 500 Hz square waves on P1.7 and P1.6.

   \text{(8 Marks)}
Note: Answer all questions

Q1 [10 Marks] Answer the following:
   a. Define: DHCP
   b. TCP receives a segment with destination port address 234. TCP checks and cannot find an open port for this destination. Which ICMPv4 message should be sent?
   c. Discuss the relationship between the LCP and the PPP frame.
   d. What is the relationship between IPCP and NCP?
   e. What is multiple access? Draw a flow diagram for the access control used in wireless LAN.

Q2 [10 Marks] A) The value of the first few bytes of a frame is 7EFFC0C0210911001416. What is the protocol of the encapsulated payload? What type of packet is being carried? How many bytes of information are in the packet?
   B) Show the contents of a configure-nak (0316) in LCP. Encapsulate the packet in a PPP frame.

Q3 [15 Marks] A) A router with IPv4 address 125.45.23.12 and Ethernet physical address 23:45:AB:4F:67:CD has received a packet for a host destination with IP address 125.11.78.10. Show the entries in the ARP request packet sent by the router.
   B) Show the entries in the ARP packet sent in response to (A).
   C) Encapsulate the result of (B) in a data link frame. Fill in all the fields.

Q4 Lab questions: [15 Marks]
   A) Java Programming
      a. Write the suitable code for designing Internet logging window. This window contains the following information: (Username, Password). For assumption that a database for many users is available, check if the entered username and password are within this database or not. Then according to result print if the user is access granted or not.
      b. List the advantages of using final word.
B) Networks Lab

a. Design a specific topology on HUBOX device that send a broadcast message to all ITS machines except ITS4 & ITS6? (2.5 Marks)

b. Which command give the details shown below:

<table>
<thead>
<tr>
<th>Internet address</th>
<th>Physical Address</th>
<th>Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>192.168.1.1</td>
<td>00-09-11-07-01-35</td>
<td>Dynamic</td>
</tr>
</tbody>
</table>

(2.5 Marks)

c. In MDDL language, can we auto-send broadcast and unicast messages together with a period of time? Explain your answer. (2.5 Marks)
Attempt Only Four Questions

Question One (20 Marks)

i.- What are the object-oriented systems development typically involves?

ii.- What the systems investigation in system development attempt to answer?

iii.- What are the steps of a formalized analysis procedure in system development? What the systems analysis report should cover?

iv.- Define the term model? What are the major types of information system models? What are the main differences between system variables and parameters.

Question Two (30 Marks)

i.- Briefly describe the tools and techniques for software development in information system implementation?

ii.- What are the factors that lead firms to seek competitive advantages? What are the relationship between strategic planning for competitive Advantage?

iii.- How information system can be measured? Define each measure. Discriminate between Performance objectives and cost objectives when establishing objectives for systems development.

Question Three (25 Marks)

i. What the system investigation involves in the traditional SDLC?

ii. What are the factors affecting systems development success

iii. Define the term Information system planning and its relation to organization goals. With the aid of diagram show the main steps of IS planning.

iv. What are the main steps of a formalized analysis procedure?

v. What are the contents of the systems analysis report?

Question Four (25 Marks)

i. What are the main features of interactive processing? What are the main elements of good interactive dialogue?

ii. How the design of IS evaluated? List the main techniques for design evaluation.

iii. With the aid of diagram show the typical steps in systems implementation.

iv. What are the main types of implemented IS tests?

v. What are the factors to consider during systems review?
Question Five (25 Marks)

i- Compare between data mart and data warehouse? What are the relation between data warehouse and data mining?

ii- Discriminate between traditional and database approach. What are the advantages of database approach?

iii- Show how a database management system can be selected?

iv- Define the term Computer-based information system (CBIS)? List five most common types of information systems used in business organizations?
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iii- Show how a database management system can be selected?

iv- Define the term Computer-based information system (CBIS)? List five most common types of information systems used in business organizations?
Note: Answer all question:

Q1. Suppose that a window has its lower left corner at (-2, -2) and its upper right corner at (10,10), for each of the following line segment, state whether it will be totally visible, totally hidden, or partially visible; by filling the following table as in the example, and for the partially visible segment, give the new coordinates.

(5 Marks)

<table>
<thead>
<tr>
<th>No.</th>
<th>Line segment</th>
<th>C1</th>
<th>C2</th>
<th>Test</th>
<th>Rem.</th>
<th>New coordinates</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ex</td>
<td>(4,4),(6,6)</td>
<td>0000</td>
<td>0000</td>
<td>0000</td>
<td>Totally visible</td>
<td>Same as the old values</td>
</tr>
<tr>
<td>A</td>
<td>(0,0),(12,12)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>B</td>
<td>(5,-5),(5,20)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>C</td>
<td>(-6,6),(18,6)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>D</td>
<td>(-2,-2),(-2,2)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>E</td>
<td>(12,-2),(15,12)</td>
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</tr>
</tbody>
</table>

Q2. Find the Homogenous matrix for the following object.

(6 Marks)

Verify your answer using at least two points.

Q3. Using Bresnham's circle drawing to find the X, Y coordinates of the pixels which represent the circle of center at (15, 5) and with radius of 8.

(6 Marks)
Q4. Find the 3D Homogenous matrix that rotate an object by (90 Deg.) around the line that pace through p1(5,6,7) and p2(5,4,3).

Q5. Discuss in **details three** of the following:

1. 2D clipping.
2. Raster scan display.
3. Windowing.

--- Practical ---

Q1. Write C++ function for DDA line drawing.  

Q2. Write C++ function for 2D line clipping.  

Q3. Write C++ function for flood fill method.  

Q4.

A. Write C++ function that returns a rotate around Z matrix.

B. Write C++ function that returns a perspective projection matrix.
Answer ALL Questions

Q1 Sketch the Bode plot for \( G(s) = \frac{80}{s^2(s + 4)} \).

Q2 For the control system shown below, find the range of \( K \) that ensures closed-loop stability.

Q3 Given the control system below, find the value of \( K \) so that there is 10\% error in steady state.

Q4 Determine the range of sampling time \( (T) \), that will make the system shown below stable.

Q5 Check the stability of the following digital control system:

\[
G(z) = \frac{0.8z^{-1}}{1 - 1.3z^{-1} + 0.46z^{-2} - 0.048z^{-3}}
\]
Useful s and z Transforms:

<table>
<thead>
<tr>
<th></th>
<th>X(s)</th>
<th>x(t)</th>
<th>x(kT) or x(k)</th>
<th>X(z)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1</td>
<td></td>
<td>Kronecker delta δ(k)</td>
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<tr>
<td></td>
<td></td>
<td></td>
<td>1(k)</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>1/s</td>
<td>1(t)</td>
<td>1(k)</td>
<td>1</td>
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<tr>
<td></td>
<td></td>
<td></td>
<td>(1-z^-1)</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>1/(s+a)</td>
<td>e^at</td>
<td>e^{-at}T</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>(1-e^{-at}z^-1)</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>1/s^2</td>
<td>t</td>
<td>kT</td>
<td></td>
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<td></td>
<td></td>
<td></td>
<td>(1-z^-1)^2</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>2/s^3</td>
<td>t^2</td>
<td>(kT)^2</td>
<td></td>
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<tr>
<td></td>
<td></td>
<td></td>
<td>T^2z^-1(1+z^-1)</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>(1-z^-1)^3</td>
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</tr>
</tbody>
</table>

The Jury's test: the necessary and sufficient conditions for the polynomial Q(z) to have NO roots outside the unit circle are;

Q(1) > 0  \quad (-1)^n Q(-1) > 0

\[ |a_0| < a_n \quad |b_0| > |b_{n-1}| \]
\[ |c_0| > |c_{n-2}| \quad |d_0| > |d_{n-3}| \]

Where,

\[ Q(z) = a_n z^n + a_{n-1} z^{n-1} + \cdots + a_1 z + a_0 = 0 \quad (a_n > 0) \]

\[ b_k = \begin{vmatrix} a_0 & a_{n-k} \\ a_n & a_k \end{vmatrix} \quad k=0 \ldots n-1, \]

\[ c_k = \begin{vmatrix} b_0 & b_{n-k} \\ b_{n-1} & b_k \end{vmatrix} \quad k=0 \ldots n-2, \]

\[ d_k = \begin{vmatrix} c_0 & c_{n-2-k} \\ c_{n-2} & c_k \end{vmatrix} \quad k=0 \ldots n-3, \text{ and so on} \]