Q1: The Circuit shown in fig(1) has been in operation for along time. At t=0, the voltage source reverses its polarity and the current source drops from 3mA to 2mA. Find $V_c(t)$ for $t \geq 0$. Find (t) at which $V_c = 0$.

Q2: Using Mesh Analysis, find the current (I) for the circuit shown in fig(2).

Q3: A/ For the circuit in fig(3-a), find the value of $z_e$ for maximum Power transfer to $z_i$ and find the value of this power.
   B/ Find $V_o$ for the circuit shown in fig(3-b) using Nodal Analysis.

Q4: A/ Find (I) taken from the (6V) voltage source for the circuit shown in fig(4-a) using successive source transformation
   B/ Find (I) through the resistance(3Ω) for the circuit in fig(4-b).

Q5: When the impedance $Z_1$ is connected separately across a voltage supply of 100 volt, 50Hz, the current pass through it is (20)Amp, at (0.6) Power factor lag. When another impedance $Z_2$ is connected in parallel with the first impedance across the same voltage supply, the total current taken from the supply is (25) Amp with (0.8) P. f. lag, find:
   1. $Z_1$ and $Z_2$. 
   2. Branch currents.
   3. Total impedance (Z) and total Admittance (Y).
   4. Complex power (active, reactive) taken from the supply.
   5. Correct the P.F. to (0.95) lag and find value of the corrective load.
Q1/ Replace the block diagram drawn here with an equivalent logical circuit that works according to the following table. Use Multiplexers (8 * 1)

<table>
<thead>
<tr>
<th>M</th>
<th>N</th>
<th>S</th>
<th>R</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>0</td>
<td>(AB)'</td>
<td>A</td>
</tr>
<tr>
<td>0</td>
<td>1</td>
<td>A'B</td>
<td>A'</td>
</tr>
<tr>
<td>1</td>
<td>0</td>
<td>B'</td>
<td>B</td>
</tr>
<tr>
<td>1</td>
<td>1</td>
<td>A</td>
<td>B'</td>
</tr>
</tbody>
</table>

Q2/ Draw a complete circuit diagram of a ROM of (8 * 4-bit) that was saved with these Hexadecimal data (0, 2, F, A, 6, 9, B, C) from address 0 to address 7.

Q3/ Design up / down counter of 2-bit. If input M=1 the counter stop counting but if M=0 the counter works in the usual way. Use T- flip flop in your design.

Q4/ a) Write a hazard free Boolean expression for the following canonical form

\[ X = \sum_m (0, 2, 4, 5, 6, 7, 8, 9, 12, 13) \]

b) Convert the following numbers to the system written against each of them:

- 16CH to Decimal
- 1001 1011 Excess-3 to Binary

Q5/ Design a logical circuit using 4-bit adders and any gate needed for that. The circuit adds number 5 to any input number consists of 3-bit. Then it checks the result, if it is less than 8 it add 7 if not it add 4.
a) Use 74HC85 which its diagram is shown below to construct a comparator for binary number each one consists of 6-bit.

```
<table>
<thead>
<tr>
<th>74HC85</th>
</tr>
</thead>
<tbody>
<tr>
<td>A&gt;B o/p</td>
</tr>
<tr>
<td>A=B o/p</td>
</tr>
<tr>
<td>A&lt;B o/p</td>
</tr>
<tr>
<td>A&gt;B i/p</td>
</tr>
<tr>
<td>A=B i/p</td>
</tr>
<tr>
<td>A&lt;B i/p</td>
</tr>
</tbody>
</table>
```

b) Put (✓) or (✗) against each of the following:
1. All the outputs of a (BCD to 7-segment decoder for common anode) equal to “1” when LT=0.
2. In Mux chip of 74151 the strobe pin is an inverting of the main output Y.
3. A decoder with enable may be used as Multiplexer.
4. A POS logical circuit can be performed by using NOR gates.
5. The outputs of a thumb wheel are 1 to 10 that gives “0001” to “1010” in binary.

With my best wishes
Static

Q1/ Replace the loading on the frame by a single resultant force (magnitude and direction). Specify where its line of action intersects member CD measured from end C.

Q2/ Determine the force in members DF and DE of the truss shown.

Q3/ Determine the range of mass m for which the 100 kg block is in equilibrium. All wheels and pulleys have negligible friction.

Thermodynamics

Question A closed system contains a working fluid is subjected undergoes a cycle with the following process:

(1-2) adiabatic compression according to the law \( P V^{1.3} = C_1 \) from initial conditions at a pressure of 1.2 bar and volume 0.3 m\(^3\) until the pressure increased to 12 bar.

(2-3) heating at constant pressure process, the quantity of heat is equal 187.23 kJ and the difference in internal energy equal to 144 kJ.

(3-4) isothermal expansion according to the law \( PV = C_2 \) until the volume equal to the initial volume.

(4-1) constant volume process back the initial conditions.

1- sketch the cycle on P-V diagram.

2- determine the pressure at the end of isothermal process \( P_4 \)

3- calculate summation work of the cycle.

Dynamics

Q1/ Suppose that the tangential component of acceleration of a car is given in terms of the car’s position by \( a_t = 0.4 - 0.001 s \) m/s\(^2\), where \( s \) is the distance the car travels along the truck from point A. What are the car’s velocity and acceleration in terms of normal and tangential components at point B?

Q2/ The two crates shown are release from rest. Their masses are \( m_A = 40 \) kg and \( m_B = 30 \) kg, and the coefficients of friction between crate A and the inclined surface are \( \mu_s = 0.2 \) and \( \mu_k = 0.15 \). What is the acceleration of the crates?

Strength of materials

Question The solid steel shaft DF has a diameter of 25 mm and is supported by smooth bearings at D and E. It is coupled to a motor at F, which delivers 12 kW of power to the shaft while it is turning at 50 rev/s. If gears A, B, and C remove 3 kW, 4 kW, and 5 kW respectively, determine the maximum shear stress develop in the shaft. The shaft is free to turn in its support bearings D and E.
\( Q1: \) (10marks)

A) Discuss briefly, and tell me why, for intrinsic semiconductor at room temperature:
1. Are free electrons in the valence band or in the conduction band?
2. Which electrons are responsible for current in a semiconductor?
3. At what energy level does hole current occur?

B) Find the wavelength of the electromagnetic wave which emitted from an atom when two electrons jump one from \((7^{th} \text{ to } 3^{rd})\) orbit and the other from \((\infty \text{ to } 5^{th})\) orbit? Note that: the ground state energy equal to \((-13.6 \text{ ev})\).

\( Q2: \) (10marks)

A cylindrical silicon bar has \((\text{length} = 14\text{mm}, \text{radius} = 2\text{mm})\) and electrons concentration \(10^{20} \text{ m}^{-3}\), doped with unknown amount of impurities. A constant current of 50mA is passed through the sample along its length, when the bar is placed in magnetic field of 0.88T acting along its radius, a hall voltage is obtained across the diameter \(= 0.1\text{mv})\.
1. Which type of impurities was added and what is the amount of impurities?
2. Calculate the resistivity and the conductivity for the silicon bar?
3. Calculate the voltage drop along the bar?
4. Calculate the angle between the field components?

Note that: \(\mu_p = 3 \times 10^{-2} \text{ m}^2/\text{v.s} \text{ and } \mu_n = 0.35 \text{ m}^2/\text{v.s}\)

\( Q3: \) (10marks)

A 150Hz center tapped full wave rectified voltage \(V_3\) is applied to LC filter as shown in figure below. Determine:
1. The output filter in terms of its dc value?
2. The ripple voltage \(V_r\)?
3. Ripple factor \((i)\)?
4. Sketch and label the waveform of \((V_3 \text{ and } V_{out})\)?

Note that: \(V_D = 0.42v\) for all diodes and \(\frac{N_1}{N_2} = \frac{1}{4}\)
Q4: (10 marks)

A p-n junction was formed from two pieces of silicon contain \( N_D = 2 \times 10^{21}\text{cm}^{-3} \) and \( N_A = 4 \times 10^{20}\text{cm}^{-2} \) at room temperature, and the relative permittivity \( \varepsilon_r = 11 \). Find the width of the depletion region in p-side (\( d_p \)) and the width of the depletion region in n-side (\( d_n \))? Take \( n_i = 10^{16}\text{cm}^{-3} \).

Q5: (10 marks)

For the DTL NAND gate in figure beside.
\[ \beta = 20, R_B = 5k\Omega, R_C = 500\Omega, V_{CC} = 5\text{v}, \]
\[ V_{CESAT} = 0.3\text{v}, V_{BE} = V_D = 0.7\text{v}. \]
Determine \( I_B, I_C \), mode of operation and no-load output for the transistor when:
1) Input A=5v and input B = 0.3v?
2) Input A=5v and input B = 2v?

Q6: (10 marks)

The LED in Figure beside requires 30mA to emit a sufficient level of light. Therefore, the collector current should be at least 30mA. For the following circuit values, determine the amplitude of the square wave input voltage \( V_{in} \) necessary to make sure that the transistor saturates. Use double the minimum value of base current \( (2\times I_{Bmin}) \) as a safety margin to ensure saturation. \( V_{CC} = 9\text{v}, V_{CESAT} = 0.3\text{v}, \beta = 50, R_B = 3.3k\Omega, R_C = 270\Omega \) and \( V_{BE} = 0.7\text{v} \).

---

**Bon chance**

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**Useful constants:**
charge of electron = \(1.6\times10^{-19}\text{C}\).
permittivity of space = \(8.85\times10^{-12}\text{F/m}\).
Boltzmann constant = \(1.38\times10^{-23}\text{J/°K}\).
mass of electron = \(9.1\times10^{-31}\text{Kg}\).
Plank's constant = \(6.626\times10^{-34}\text{J.s}\).
speed of light = \(3.0\times10^8\text{m/s}\).
ملاحظة: ملاحظة إجب عن اربعة أسئلة على ان يكون السؤال الثالث من ضمنها (الدرجات بالتساوي)

س1/أ.عرف مايأتي (الحق - عقد الزواج - الدولة - الجنسية)

ب.شرح بإيجاز موقف الشريعة الإسلامية من حق الإنسان قبل ولادته واثناء حياته وبعد وفاته؟

س2/ بين السند الشرعي والقانوني لحق الإنسان في الحياة. وذكر أهم الواجبات التي يجب على الدولة القيام لحماية هذا الحق.

س3/ هناك جملة من الحقوق اللفيقية بالشخصية التي اقرتها المواثيق الدولية ...، اذكرها؟

س4/ خدماتي:

1- أهم المركبات التي يقوم عليها القانون الدولي والقانون الدولي الإنساني
2- أهم مصادر دراسة حقوق الإنسان في حضارة وادي الرافدين

س5/ لعقد الزواج جملة من الشروط. بینها؟ وذكر أهم الحقوق التي تتربت على هذا العقد بين الزوجين

تمنياتي لكم بالنجاح والتفوق
Q1 Find

(a) \( \frac{dy}{dx} \) if \( y = e^{\sin(x^2+1)} \)

(b) \( \frac{d^2y}{dx^2} \) if \( 2x^3 - 3y^2 = 8 \) at point (1, 1).

Q2 If \( A = \begin{bmatrix} -1 & -1 & 2 \\ -3 & 0 & 1 \end{bmatrix} \), \( B = \begin{bmatrix} 2 \\ 1 \\ 1 \\ 4 \end{bmatrix} \), find \( C = (AB)^{-1} \) and \( D = (BA)^T \).

Q3 Answer only ONE

(a) Find the area of the region enclosed by the curve \( y = x^2 - 2 \) and the line \( y = 2 \).

(b) Is this series converges or diverges? If it converges, find its sum.

\[ \sum_{n=0}^{\infty} \left( \frac{1}{\sqrt{2}} \right)^n \]

Q4 Evaluate

(a) \( \int \frac{2x + 1}{x^2 + 1} \, dx \)

(b) \( \int \frac{dt}{t^3 + t^2 - 2t} \)

Q5 Answer only ONE

(a) Replace the polar equation \( r = \frac{5}{\sin \theta - 2 \cos \theta} \) by equivalent Cartesian equation.

Then sketch the function.

(b) Find the Taylor polynomial of order 1, 2, and 3 for \( f(x) = \frac{1}{x} \) at \( x = 2 \).

Q6 (a) Find the equation of the plane through points \( P(1, 1, -1), Q(2, 0, 2) \) and \( R(0, -2, 1) \).

(b) Solve (find the values of \( Z \) that satisfy the equation) \( Z^3 + j27 = 0 \).
Q1: Given Front view, Top view & Right side view draw the Isometric body using scale 1:1. (All dimension in millimeters). 20%

Q2: Draw the main views Front, Right side & Top views for the given isometric drawing in scale 1:2. (All dimension in millimeters). 20%

Q3: Draw the given figure using scale 1:1 showing all the tangent points and arcs centers. (All dimension in millimeters). 20%

10%}

س4:(ا) أجب بعبارة صح أو خطأ لكل من العبارات الآلية مع تصحيح الخطأ إن وجد:

1- يعمل الإباعز Erase من الأمر ALL على مسح آخر كيان تم رسمه.
2- يعمل الإباعز من الأمر Array على استنسل الرسوم بشكل صفوف وأعمدة.
3- يستخدم الإباعز Xclips لإجراء تعديلات على القوالب والمراجع الخارجية.
4- يعمل الخيار OFF من الأمر Limits على منع خروج الرسم خارج اللوحة.
5- يعمل الخيار Zoom من الأمر Object على تكبير الجسم الذي يتم اختياره.

10%

(ب) إملاء الفراغات الآلية بكلمات مناسبة:

1- يعمل الخيار ______ من الأمر Lengthen على تطويل أو تقصير بديري بالماوس وهذا الخيار ليسري ______.

2- نغرض الأمر ______ لعرض التطور فوق لوحة الرسم.
3- نغرض الاقتباس أجزاء من رسوم كاملة وإدراجها في ملف منفصل كتالب فإننا نستخدم الإباعز ______ (Arc / Line / Pline).
4- نغرض الأمر ______ لعمل فتحات في عنصر ______.
Question 1:
Write C program to read three integer sides of a triangle, then check and print if the triangle is equilateral or not.

Question 2:
Using the while statement, write C program to compute and print to console average of sum of integers from 1 to 1000 excluding multiples of 7 integers (integers accept division by 7 without remainder).

Question 3:
Write C program in which to define the following macros:
- Sec to compute the secant of a given angle in degrees
- Bprint to print any given long integer in binary form

Apply above macros in main program to print secant of (30°), and the number (65800) in binary form.

Question 4:
Write C function to solve the following equation for any given values for x and y:
\[ z = f(x, y) = \sqrt{|x^3 + y^3|} \]

Use function in main program to compute and print value of z for values of x and y read interactively from console.
Question 1:
Fill the blanks in the following sentences with the correct missing words or numbers:

a. The format ...... character is used for the unsigned long integer data type.
b. The delay function is located in the ...... C standard library.
c. The ........ function is used to return the inverse of natural logarithm.
d. In C language, the function that can return maximum integer not greater than a given variable is called the ........ function.
e. Macros in C programs can be defined as a ......... identifier represents a whole single statement.
f. Identifiers in C programs should not start with a ..........
g. For the statement, char A=160; value of A will take the value of ........... in decimal.
h. The defined array in C program, long A[3][5]; will have the size of ... bytes.
i. For the statement, char C=7; C will take the value .......... in hexadecimal.
j. For the statement, int B=(0x38^56)|0x24; value of B will be .......... in decimal.

Question 2:
A. Write C program to read a float number representing radius of a ball, then check and print if the ball volume is less than, greater than, or equal to (100) cubic units, if you know that volume of ball is given by \( \frac{4}{3}\pi r^3 \) where \( r \) is the ball radius.

B. Sketch exactly what will be printed by the following piece of C program:

```c
clrscr();
for ( int x=1 ; x <= 7 ; x++ )
for ( int y=1 ; y <= 5 ; y++ )
{
  gotoxy (x,y);
  if ( ( x%2 != 0 ) || y==3 || ) printf("X");
}
```

Question 3:
A. Write C program that can print in decimal the ASCII code for any key to be pressed from keyboard during execution of the program. Program should terminate only if user press the Escape key, if you know that ASCII code for Escape key is (27) in decimal.

B. Write C program to define the following macros:

- **CLS** to clear the text mode screen
- **AVG** to return the average of three given inputs
- **SQRT** to return the square root of a positive input, and zero value for negative inputs.

Show how you apply these macros in main program, using direct or indirect substitution of parameters if required.
Question 4:

A. What will be the elements of array (W) after applying the following piece of C program:

```c
int W[5][5], i, j;
for ( i=0 ; i < 5 ; i++ )
  for ( j=0 ; j < 5 ; j++ ) W[i][j]=7;
for ( i=0 ; i < 4 ; i++ )
  for ( j=i+1 ; j < 5 ; j++ )
  {
    W[i][j]=2*i;
    W[j][i]=-2*j;
  }
```

B. Write C program to define the following array:

\[
X = \begin{bmatrix}
-1 & 5 & 7 & 2 & 11 \\
7 & -6 & 8 & -2 & -8 \\
4 & -4 & 3 & 6 & 10 \\
-2 & 2 & 1 & 12 & -5 \\
\end{bmatrix}
\]

Then write the statements to set the elements in row and column of maximum element to zero. Finally print out array to console.

Question 5:

A. Write C program to define one dimensional array float data type of (64) elements, read elements interactively from console, then write the statements that can add a random number between -12.5 and +12.5 to each element in the array. Finally count and print the number of negative elements in the array.

B. Write C function that can return average of sum of each row in two dimensional array of float data type elements with maximum (64) columns. Apply function in the main program to get and print average of each row of the following array:

\[
E = \begin{bmatrix}
3.6 & -1.2 & 4.0 & 6.8 \\
-1.0 & 3.9 & 2.1 & -4.9 \\
2.0 & -4.4 & 9.2 & 5.1 \\
\end{bmatrix}
\]

GOOD LUCK