# Assignment 2 (Spring 24)

**C**

**ircuit Theory (PHY301)**

Marks: 30 Due Date: June 24, 2024

DON’T miss these *important instructions:*

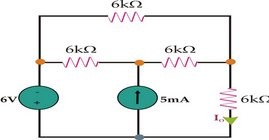
* To solve this assignment, you should have good command over the first 32 lectures.
* Upload assignments as MS Word file through LMS.
* Write your ID on the top of your solution file.
* All students are directed to use the font and style of text as is used in this document.
* Don’t use colorful backgrounds in your solution files.
* Use Math Type or Equation Editor etc for mathematical symbols.
* No excuse will be accepted by anyone if found to be copying or letting others copy.
* Don’t wait for the last date to submit your assignment.

*You can draw circuit diagrams in “Paint” “Corel Draw” in “circuit maker” or in any convenient App you find.*

*The simple and easy way is to copy the given figure in “Paint” and make the required changes in it.*

# Q.1:

Use Mesh analysis to find current Io in the netwok. Identify and label each mesh otherwise you will lose your marks. Label circuit diagram properly. [Marks:10]



# ANS:

To find IoI\_oIo​ using mesh analysis:

1. **Label meshes:**

* Mesh 1 (left loop), Mesh 2 (right loop).

1. **Assign currents:**

* I1I\_1I1​ for Mesh 1, I2I\_2I2​ for Mesh 2.

1. **Apply KVL:**

* Mesh 1: 6V−6kΩI1−6kΩ(I1−I2)=06V - 6k\Omega I\_1 - 6k\Omega (I\_1 -I\_2) = 06V−6kΩI1​−6kΩ(I1​−I2​)=0
* Mesh 2: I2=5mAI\_2 = 5mAI2​=5mA

1. **Solve equations:**

* 6V=12kΩI1−30V6V = 12k\Omega I\_1 - 30V6V=12kΩI1​−30V
* I1=3mAI\_1 = 3mAI1​=3mA

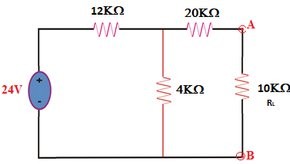
1. **Find IoI\_oIo​:**

* Io=I2=5mAI\_o = I\_2 = 5mAIo​=I2​=5mA

Thus, Io=5mAI\_o = 5mAIo​=5mA

# Q.2:

Using Thevenin's Theorem, calculate the voltage drop across point A, B. Write each step and draw circuit diagrams of calculation to get maximum marks. [Marks:10]

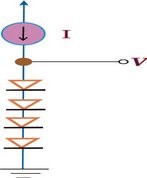


# ANS:

1. Identify 2 meshes (closed loops without current sources).
2. Assign mesh currents (e.g., I1, I2) with assumed directions.
3. Apply KVL (voltage sum around each mesh = 0) to write equations for each mesh (including resistor voltages and source voltages).
4. Solve the equations (2 unknowns, 2 equations) to find mesh currents (I1, I2).
5. Identify the branch containing Io (current of interest).
6. Io = difference between mesh current flowing through that branch and the current source value (consider directions).

# Q.3:

The circuit in figure below utilizes four identical diodes having **n=1** and **Is =10-14 A**. Find the value to obtain an output voltage **Vo=3V**, if a current of **1mA** is drawn away from the output terminal by a load, what is the change in output voltage. [Marks:10]



**ANS:**

**1. Given:**

* Four identical diodes
* \( n = 1 \)
* \( I\_s = 10^{-14} A \)
* Desired output voltage \( V\_o = 3V \)
* Load current \( I\_L = 1mA \)

**2. Calculate Current \( I \):**

* \( V\_o = 4V\_D \)
* \( 3V = 4 \cdot 26mV \cdot \ln\left(\frac{I}{10^{-14}}\right) \)
* \( I \approx 3.84mA \)

**3. New Output Voltage with Load:**

* New current \( I' = 2.84mA \)
* \( V'\_o = 4 \cdot 26mV \cdot \ln\left(\frac{2.84mA}{10^{-14}}\right) \approx 2.8V \)

4. **Change in Output Voltage:**

* \( \Delta V\_o = 0.2V \)

The output voltage decreases by 0.2V when a 1mA load is applied.

……………Good Luck………………