## Question 1: 10 Marks

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| --- | --- | --- |
| In the above circuit **,**  and . Answer the following questions | | |
| 1. Write the node equations for the nodes indicated by and . | [CO1] | 4 |
| 1. Solve the node equations to find the values of and **.** | [CO2] | 3 |
| 1. Can circuit theorems based on linearity principle (such as superposition principle) be applied to the above circuit? Explain in short why or why not. | [CO1] | 3 |

## Question 2: 8 MarksA diagram of a circuit Description automatically generated

|  |  |  |
| --- | --- | --- |
| For , , , , and . | | |
| 1. Find , | [CO2] | 4 |
| 1. Find , **.** | [CO2] | 4 |

## Question 3: 10 Marks

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| --- | --- | --- |
| In the adjacent circuit **.** | | |
| 1. Derive an expression of in terms of and **.** | [CO1] | 3 |
| 1. Find the value of the currents **,** and **.** | [CO2] | 4 |
| 1. Find the value of the voltage at the output node . | [CO2] | 3 |

## Question 4: [CO2] 12 Marks

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| --- | --- |
| * 1. Assume that the Op-amp on the right is ideal. The wave shapes of and are shown on the adjacent graph. * **Draw** the waveshape of the output voltage of the op-amp on the graph provided above. Indicate the time () in which switching would occur in  **(Print this page and draw the graph on the same graph paper)** | 6 |
| * 1. Assume that the Op-Amp on the right is ideal. Answer the following questions.  1. Sketch accurately the graph of vs  **(VTC).** 2. Sketch accurately the graphs of vs **.** Find out the time () in which switching would occur in | 6 |

## Question 5: 10 Marks

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|  |  |  |
| 1. For , and , find and **.** | [CO3] | 3 |
| 1. Find the value of and the new saturation voltages (positive and negative) to implement the waveshape in the right figure. | [CO3] | 4 |
| 1. Design a circuit using op-amp that has the voltage transfer characteristics as shown in the figure below. is the output voltage and is the input voltage. | [CO3] | 3 |

## Question 6: 10 Marks

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| --- | --- | --- |
|  | | |
| 1. [] Write down the two KVL equations for the lines (loops) indicated by the red lines and **.** | [CO1] | 3 |
| 1. [] Solve the circuit to find , and **.** You may use either mesh analysis or nodal analysis. | [CO2] | 4 |
| 1. Design the circuit; i.e., find to get . [Use any technique of your choice.] Find and . | [CO2] | 3 |