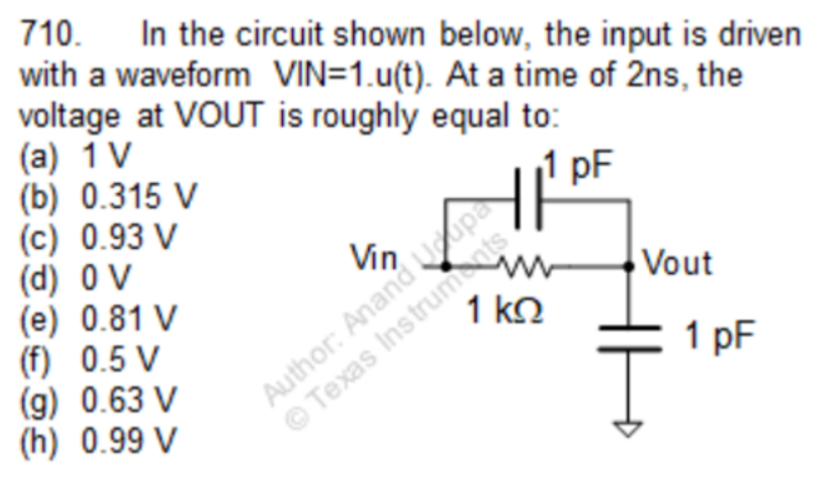
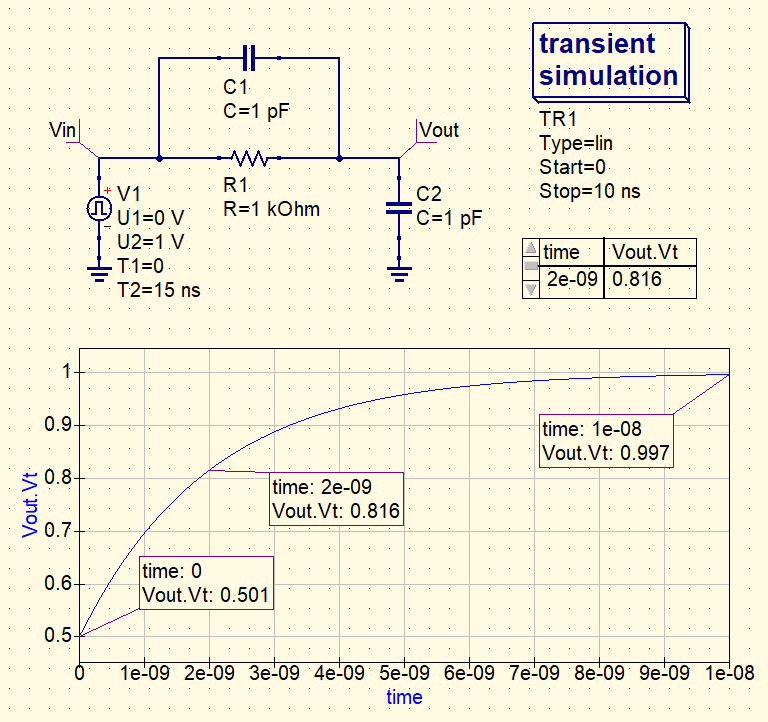
**TI BYTE Simulation Exercise**

**Week 5 : Buffers**

* **Question 1:**

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* **QUCS Circuit:**

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* **Vin is the input given with waveform Vin = 1.u(t)**
* **Vout is used to label the output node and find the voltage at that node.**
* **Both the capacitors are uncharged and have zero initial voltage in them.**
* **QUCS Result:**

**Therefore, from the simulation, we get our answer as:**

**Vout | at t = 2 ns = 0.816 V ≈ 0.81 V**

**Answer: (e)**

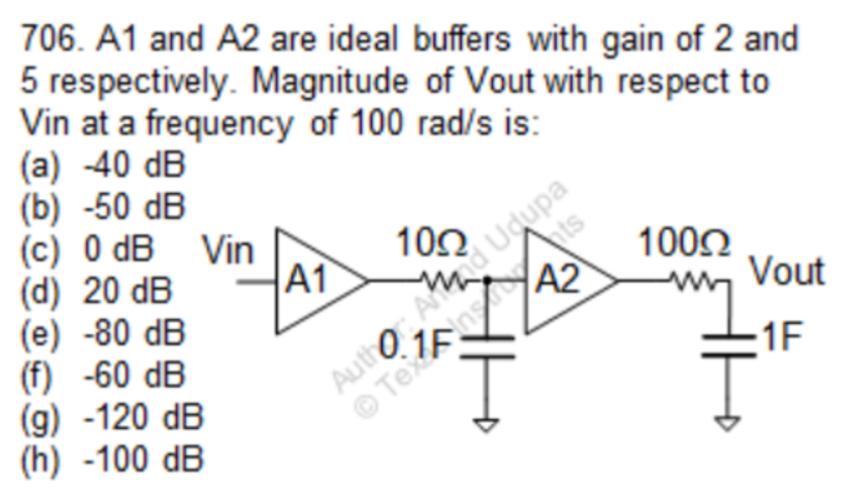
* **Conclusion:**
* **Initially, since the capacitors are uncharged, they provide minimal impedances. So, at t = 0+,**
* **At t = ∞, the capacitors are charged and behave as o.c., therefore,**
* **The of the circuit between and is = 1 kΩ**
* **The of the circuit between and is = 1 pF + 1 pF = 2 pF**
* **Time constant of the circuit =**
* **Therefore, using the F.I.F. formula, we get the charging curve of across the capacitor C2,**

**where, = and = .**

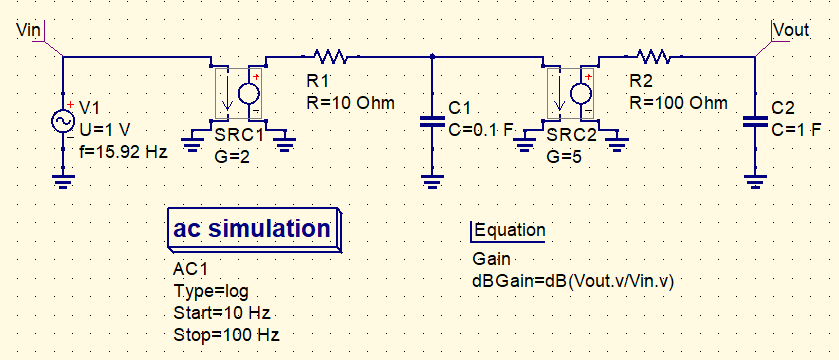
* **Thus, at t = 2 ns,**

**= 0.816 V**

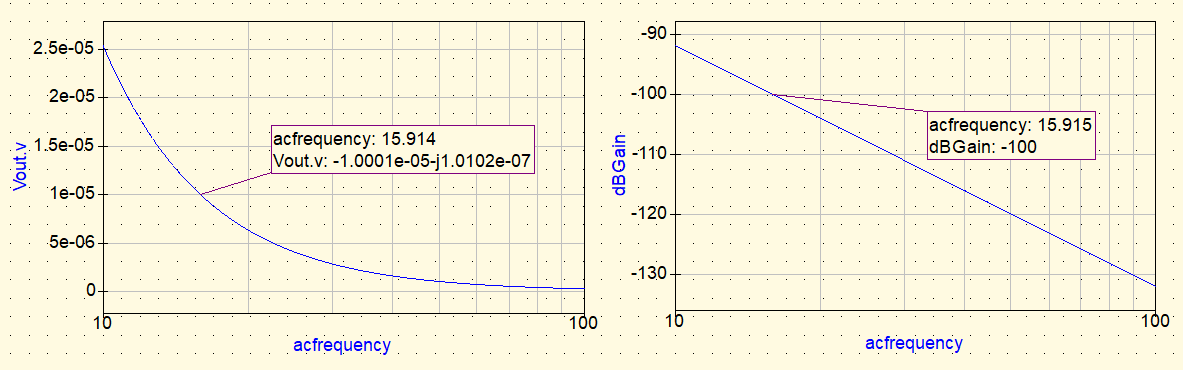
* **Thus, our answer is verified with the simulated result.**
* **Question 2:**

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* + **QUCS Circuit:**

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* **Vin is a sinusoidal input given with an amplitude of 1V and frequency of 100 rad/s = 15.915 Hz**
* **Vout is used to label the output node and find the voltage at that node.**
* **Both the capacitors are uncharged and have zero initial voltage in them.**
* **The Buffer Amplifiers are implemented using Voltage Controlled Voltage Sources (VCVS), since they are ideal buffers with infinite input resistance and zero output resistance.**
* **QUCS Result:**

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**Therefore, from the simulation, we get our answer as:**

**Av = -1.0001e-05 – j1.0102e-07 = -100 dB**

**Answer: (h)**

* **Conclusion:**
* **The Transfer function can be given by.**
* **Thus H(s) has two poles and no zeroes.**
* **The total DC gain between and = A1 × A2**

**= 2 × 5 = 10**

**= 20 dB**

* **Now, due to the presence of the buffers, the two RC circuits R1C1 and R2C2 are electrically isolated. Thus, the effect due to the poles are also independent of each other.**
* **Therefore, the pole due to R1C1 is,**

**and, the pole due to R2C2 is,**

* **Since both the pole lie on the -ve s-axis of the s-jω plane, the system is stable.**
* **For a single pole at any frequency, the roll-off rate is -20dB/ decade.**
* **Now, at , Gain due to the individual poles,**
* **Thus, total gain at ,**
* **From the simulation, we got the same result, thus our answer is correct and verified.**