

Figure 1

4)

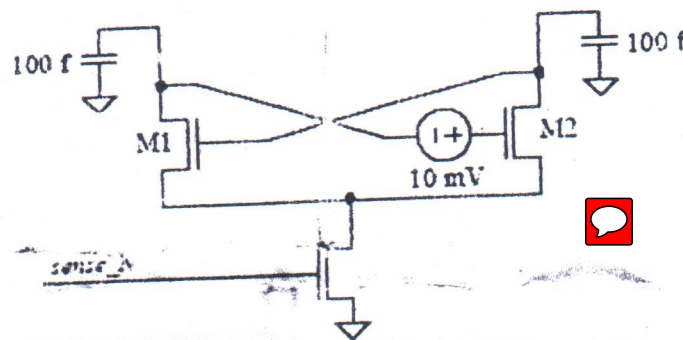


Figure 2

This question deals with mismatch between the devices constituting a simple latch sense amplifier. In figure 2, the mismatch between transistors M1 and M2 has been modeled as a voltage offset of 10mV. The devices are considered to be identical after incorporating the offset. The two bitline model capacitances are the same (100fF).

- Assuming that the output nodes are equalized at 500mV, after which the enabling signal sense_N is asserted, sketch the waveform of the voltages at the two output nodes with reference to sense_N. (3)
- Find the precharge voltages for which the circuit will be maintained at metastability. Use Spice Level 1 MOS transistor models and simple RC discharge models. Key model parameters are

$$V_{thn}=280\text{mv and }V_{dsat}=50\text{mv}$$

Mention any assumptions and/or approximations you made. (7)