REPORT ON VLSI

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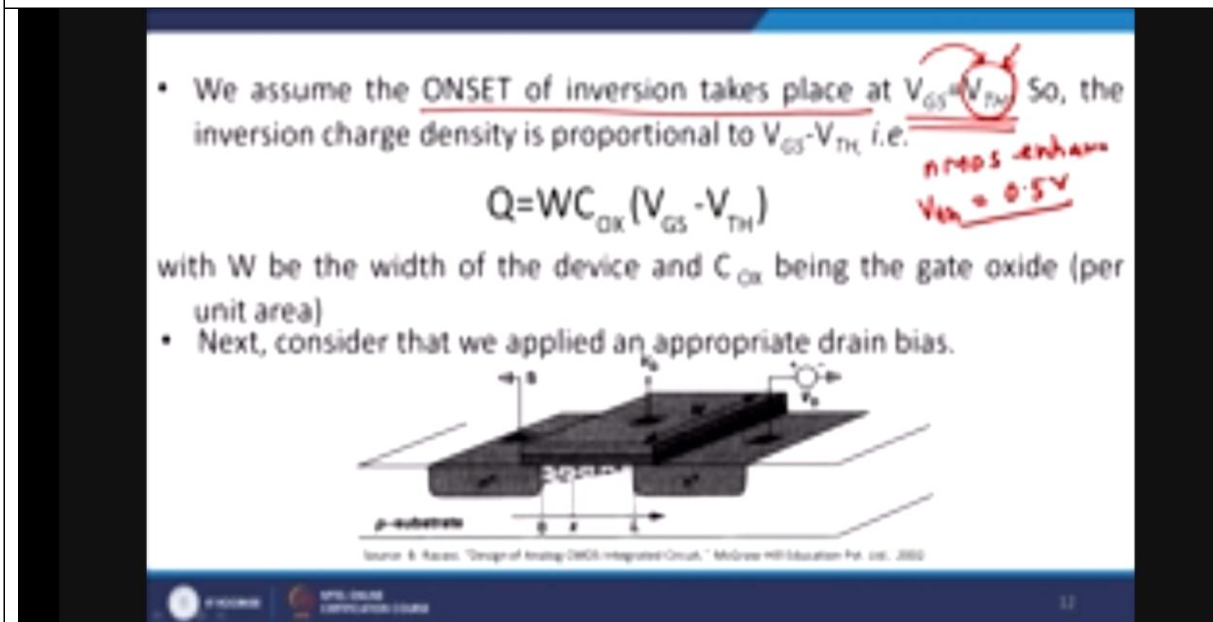
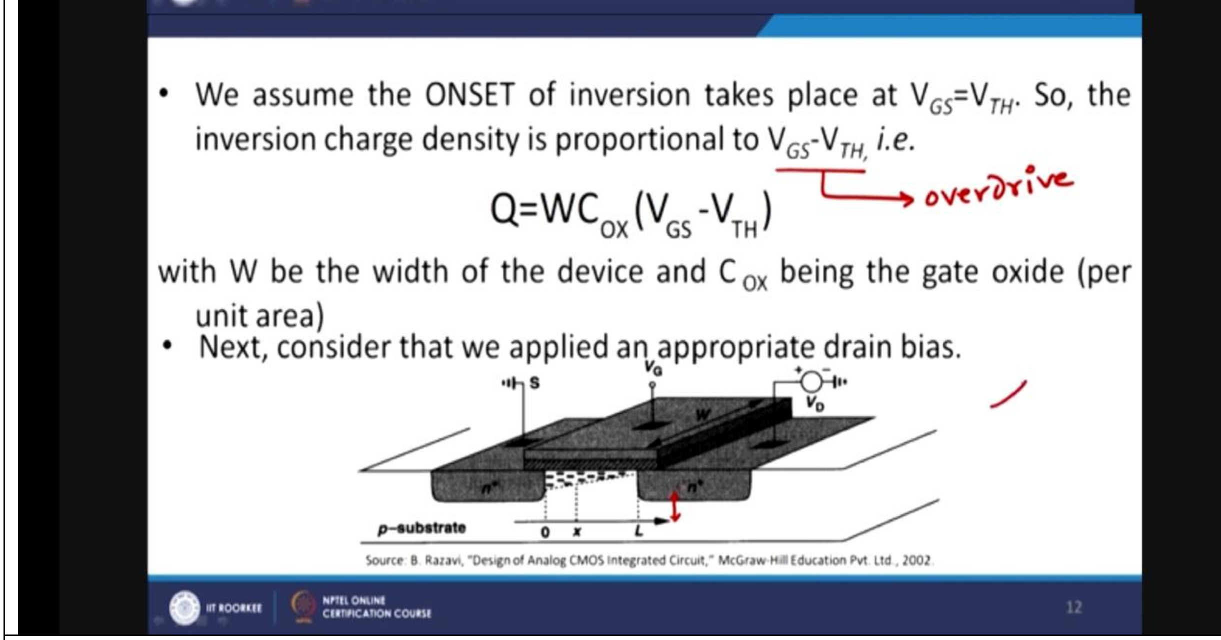
Github Repository:	**Safiya-Courses**		

FORENOON SESSION DETAILS





MOS TRANSISTOR

The metal–oxide–semiconductor field-effect transistor (MOSFET, MOS-FET, or MOS FET), also known as the metal–oxide–silicon transistor (MOS transistor, or MOS),[1] is a type of insulated-gate field-effect transistor (IGFET) that is fabricated by the controlled oxidation of a semiconductor, typically silicon. The voltage of the covered gate determines the electrical conductivity of the device; this ability to change conductivity with the amount of applied voltage can be used for amplifying or switching electronic signals.

The MOSFET was invented by Mohamed M. Atalla and Dawon Kahng at Bell Labs in 1959. It is the basic building block of modern electronics, and the most frequently manufactured device in history, with an estimated total of 13 sextillion (1.3×10^{22}) MOSFETs manufactured between 1960 and 2018.[2] It is the dominant semiconductor device in digital and analog integrated circuits (ICs),[3] and the most common power device.[4] It is a compact transistor that has been miniaturised and mass-produced for a wide range of applications, revolutionizing the electronics industry and the world economy, and being central to the digital revolution, silicon age and information age. MOSFET scaling and miniaturization has been driving the rapid exponential growth of electronic semiconductor technology since the 1960s, and enables high-density ICs such as memory chips and microprocessors. The MOSFET is considered the "workhorse" of the electronics industry.

A key advantage of a MOSFET is that it requires almost no input current to control the load current, when compared with bipolar junction transistors (BJTs). In an *enhancement mode* MOSFET, voltage applied to the gate terminal can increase the conductivity from the "normally off" state. In a *depletion mode* MOSFET, voltage applied at the gate can reduce the conductivity from the "normally on" state.[5] MOSFETs are also capable of high scalability, with increasing miniaturization, and can be easily scaled down to smaller dimensions. They also have faster switching speed (ideal for digital signals), much smaller size, consume significantly less power, and allow much higher density (ideal for large-scale integration), compared to BJTs. MOSFETs are also cheaper and have relatively simple processing steps, resulting in high manufacturing yield.

MOSFETs can either be manufactured as part of MOS integrated circuit (MOS IC) chips or as discrete MOSFET devices (such as a power MOSFET), and can take the form of single-gate or multi-gate transistors. Since MOSFETs can be made with either p-type or n-type semiconductors (PMOS or NMOS logic, respectively), complementary pairs of MOSFETs can be used to make switching circuits with very low power consumption, in the form of complementary MOS (CMOS) logic. The name "metal–oxide–semiconductor" (MOS) typically refers to a metal gate, oxide insulation, and semiconductor (typically silicon).[1] However, the "metal" in the name MOSFET is sometimes a misnomer, because the gate material can also be a layer of polysilicon (polycrystalline silicon).

Types of MOSFET

PMOS and NMOS logic

Main articles: PMOS logic and NMOS logic

Further information: Depletion-load NMOS logic

P-channel MOS (PMOS) logic uses p-channel MOSFETs to implement logic gates and other digital circuits. N-channel MOS (NMOS) logic uses n-channel MOSFETs to implement logic gates and other digital circuits.

For devices of equal current driving capability, n-channel MOSFETs can be made smaller than p-channel MOSFETs, due to p-channel charge carriers (holes) having lower mobility than do n-channel charge carriers (electrons), and producing only one type of MOSFET on a silicon substrate is cheaper and technically simpler. These were the driving principles in the design of NMOS logic which uses n-channel MOSFETs exclusively. However, unlike CMOS logic (neglecting leakage current), NMOS logic consumes power even when no switching is taking place.