SNS COLLEGE OF TECHNOLOGY

An Autonomous Institution

Coimbatore-35

Accredited by NBA – AICTE and Accredited by NAAC – UGC with 'A+' Grade

Approved by AICTE, New Delhi & Affiliated to Anna University, Chennai

DEPARTMENT OF ELECTRONICS & COMMUNICATION ENGINEERING

19ECB201-ANALOG ELECTRONIC CIRCUITS

II YEAR/ III SEMESTER

UNIT 5 – IC MOSFET AMPLIFIERS

TOPIC – Amplifier with active loads: Depletion load

NMOS Amplifier with Depletion Load

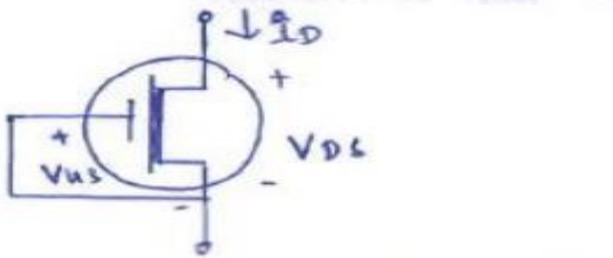

Fig: NMOS depletion mode device

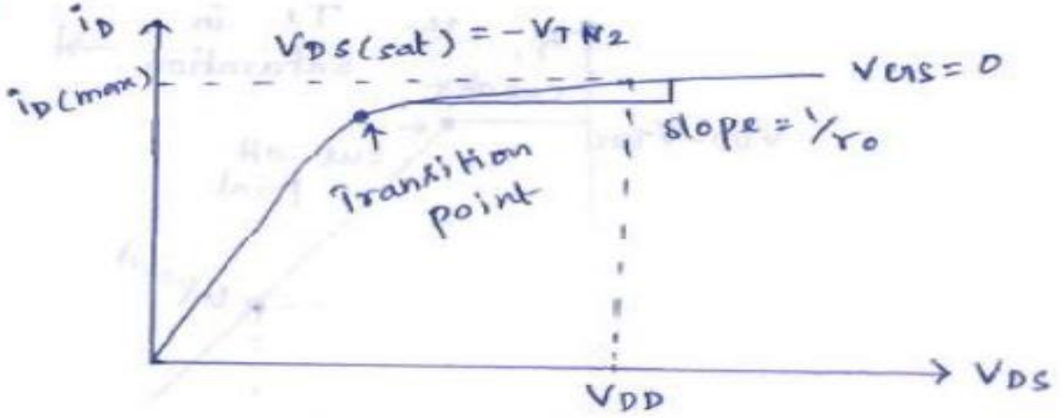

Fig: current - voltage characteristics

* Here, The Threshold voltage V_{TN2} is negative, which means That the value of V_{DS} at transition point is positive.

* Non-zero slope in the saturation region indicates that a finite resistance r_o exists in this region.

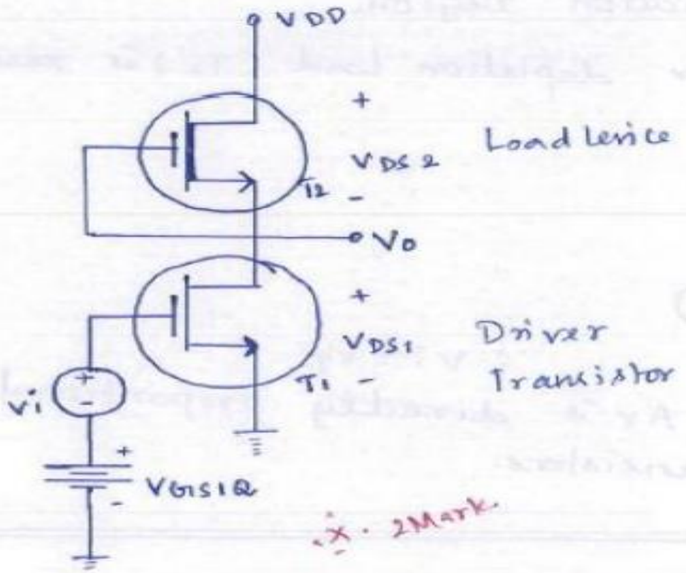

Fig: NMOS amplifier with depletion load device

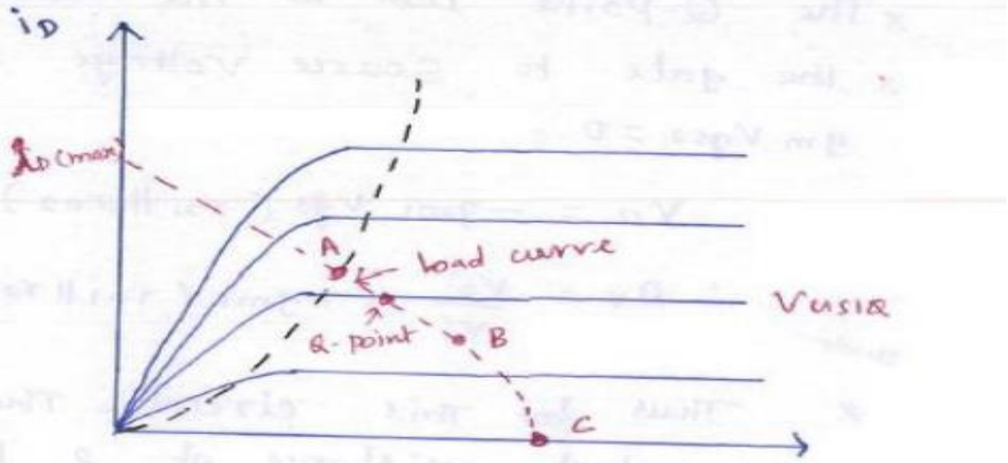

Fig: Driver transistor characteristics

A - Transition point for T_1

B - Transition point for T_2

* Here, T_1 is used as a driver & T_2 is used as a load.
* The I-V characteristics of the loaddevice is non-linear. The load curve is also non-linear.

* points A & B are transition points for T_1 & T_2.
* Q-point is approximately midway between 2 transition points.
* For amplifier operation, both MOSFET should be biased in Saturation region.

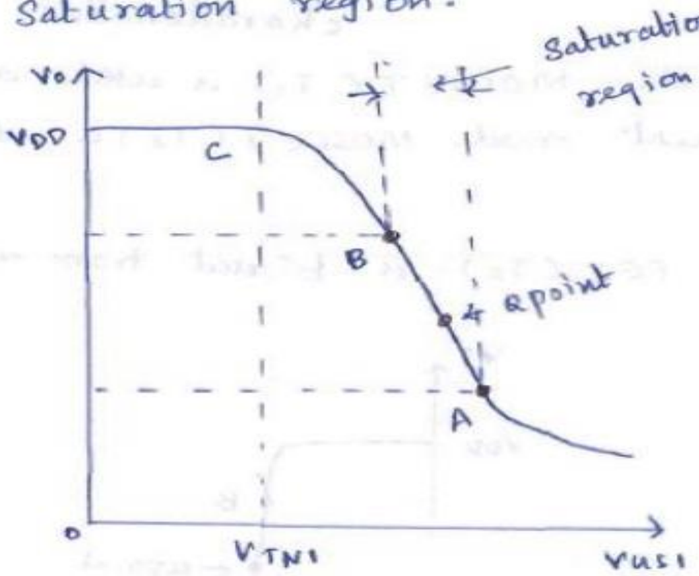

Fig: Voltage Transfer characteristics

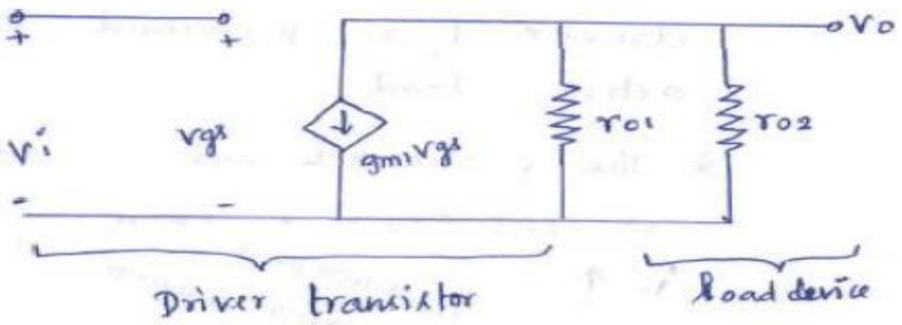

Fig: Small signal equivalent circuit

* The Q-point lies in the saturation region.
* The gate to source voltage for depletion load (T_2) is zero, $g_m V_{gs2} = 0$.

$$V_o = -g_{m1} V_{gs} (r_{o1} \| r_{o2})$$

$$\therefore A_v = \frac{V_o}{V_i} = -g_{m1} (r_{o1} \| r_{o2})$$

$\because V_i = V_{gs}$

* Thus for this circuit, The A_v is directly proportional to the output resistance of 2 transistors.

THANK YOU