



(Answer all the questions)

Co

1.a Explain the following second order effects

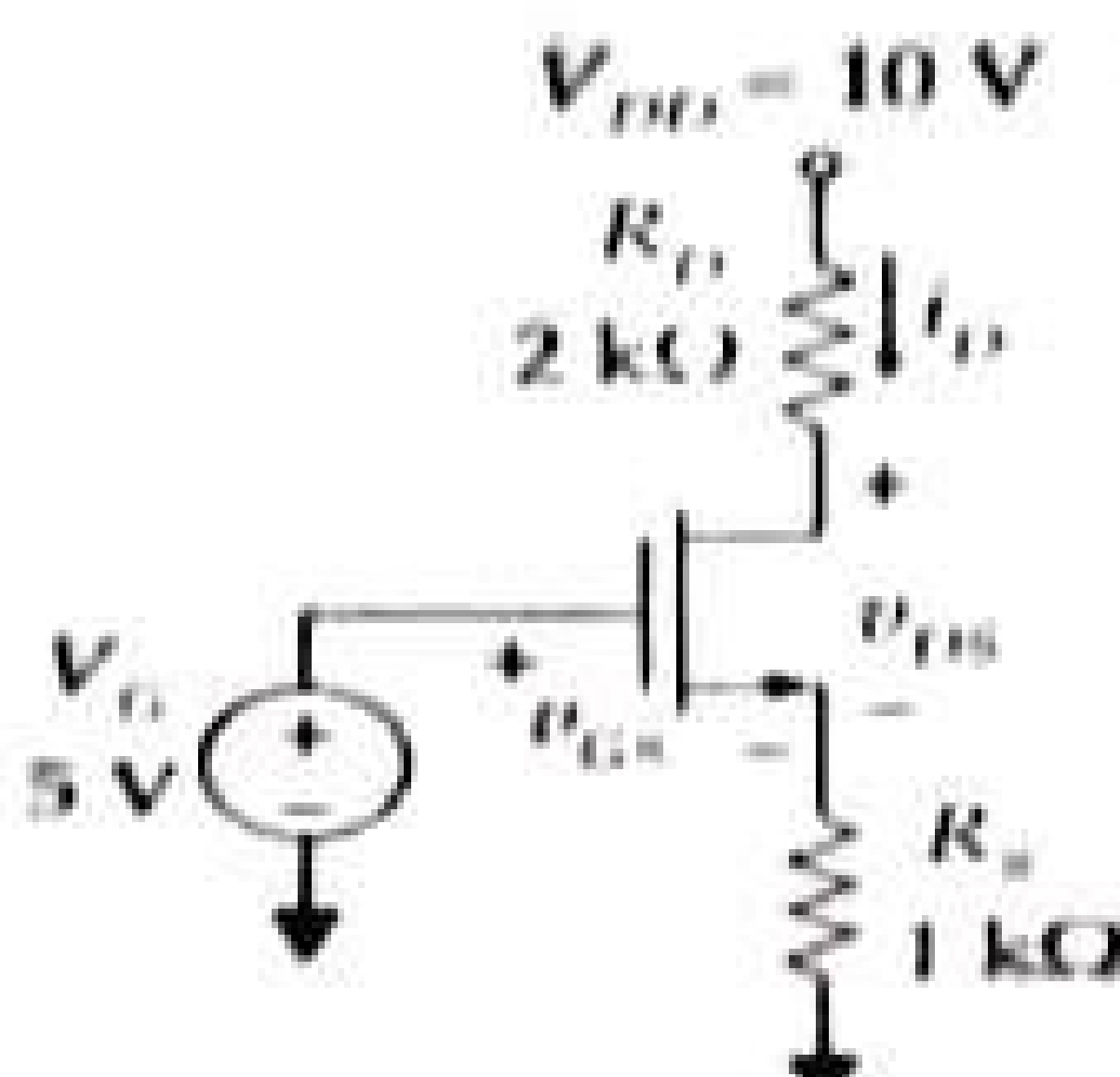
a) Body effect

b) Channel length modulation

[5] 1

1.b For the circuit shown, use the the NMOS equations to find I_D and V_{DS} .
Considering V_{th} as 1V.

[5] 1



2.a Implement the function $F = ac'd' + acd + a'cb' + a'c'b$ using NMOS pass transistor.

[5] 2

2.b Implement the CMOS Logic for the following expression

[5] 2

$$F = A\bar{B} + \bar{A}B + \bar{C} + \bar{D} + \bar{E} + \bar{F} + \bar{G}$$

3.a Design a 4x1 Multiplexer using three 2x1 Multiplexer and implement the same using PMOS pass transistor logic.

[5] 2

- 3.b Discuss the capacitance associated with each terminal of the MOSFET. [5] 1
- 4.a Consider the nMOS transistor in a $0.6\ \mu\text{m}$ process with gate oxide thickness of $100\ \text{\AA}$. The doping level is $N_A = 2 \times 10^{17}\ \text{cm}^{-3}$ and the nominal threshold voltage is $0.7\ \text{V}$. The body is tied to ground with a substrate contact. How much does the threshold change at room temperature if the source is at $4\ \text{V}$ instead of 0 ? [5] 1
- 4.b Design a positive edge triggered flip flop using 1G1s and explain its operation. [5] 2
- 5.a Implement the function $S = ABC + \overline{A}BC + \overline{A}\overline{B}C + A\overline{B}C$ using Transmission gates. [5] 2
- 5.b Determine V_o for each of the circuits shown below. Assume that $V_{th} = |V_{tp}| = 0.5\ \text{V}$, that there is no subthreshold conduction, that the capacitor is initially discharged and that there are no body effects. [5] 2

