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TEST-1 EXAMINATION- FEBRUARY -2020

B.Tech VI Semester (ECE)

COURSE CODE: 10B11EC612 MAX. MARKS: 15
COURSE NAME: VLSI TECHNOLOGY AND APPLICATIONS
COURSE CREDITS: 04 MAX. TIME: 1 HRS

Note: *All questions are compulsory. Carrying of mobile phone during examinations will be treated as case of unfair means.*

1. An nMOS transistor, operating in the linear resistance region with V_{DS} = 0.1V, is found to conduct 60μA for V_{GS} = 2V and 160μA for V_{GS} = 4V. What is the apparent value of threshold voltage V_{th}? If k_n` = 50μA/V^2, what is the device W/L ratio? What current would you expect to flow with V_{GS} = 3V and V_{DS} = 0.15V? If the device is operated at V_{GS} = 3V, at what value of V_{DS}, will the drain end of the MOSFET channel just reach pinch off, and what is the corresponding drain current? **[5] (CO1)**

2. (a) The drain current of a MOSFET in saturation is given by $I_D = k(V_{GS} - V_{th})^2$, where k is a constant. Derive the magnitude of the transconductance.

   (b) A fabricator wants to fabricate a MOSFET. He wants to calculate the junction depletion region and depletion region depth. How can he calculate both the values? Derive any one value. **[2.5 + 2.5 = 5] (CO1 and CO2)**

3. Give answer in brief with justification :
   i. When gate voltage is negative for enhancement mode n-MOS, the direction of electric field will be
   ii. The expression for threshold voltage for the enhancement mode *n*-MOS is_____
   iii. Drain and gate terminal of *n*- channel MOSFET are connected together. Voltage V_i is applied on drain terminal. For this configuration, give the voltage current relationship_____.
   iv. The Fermi potential for depletion mode *n*-substrate is _____
   v. A MOSFET in saturation has a drain current of 1mA for V_{DS} = 0.5 V. If the channel length modulation coefficient is 0.5V^{-1}, the output resistance (in the kΩ) of the MOSFET is_____ **[5] (CO1 and CO2)**