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National Institute of Technology, Hamirpur (HP)

Name of Examination: B. Tech.

(December-2022)

Branch	:	**ECE**	Semester	:	**7th**
Course Name	:	**Electronic Device Modeling**	Course Code	:	**ECD-314**

Time: 3 Hours **Maximum Marks: 50**

Note: **1)** Attempt all the questions.
2) Assume suitable data if required

Q(1) : (a) Under what condition velocity will saturate in MOSFET. **(2)**

(b) What is the condition under which MOSFET behaves as short channel device? **(2)**

(c) What does it mean "the channel is pinched off"? **(2)**

(d) We generally use the enhancement type MOSFET, so what is the utility/application of depletion type MOSFET. **(2)**

(e) Why, in general is the mobility of carriers in the inversion layer not a constant with applied voltage? **(2)**

Q(2): Drive the equation for recombination rate R, and also explain how it is used in determining of forward & reverse current of a p-n junction structure. **(10)**

Q(3): a) Draw the energy band diagram of a MOS structure in accumulation, depletion and inversion mode of operation. **(5)**

b) Explain the Sub-threshold Slope for a MOSFET and determine formula for the same. Also derive the equation for minimum sub-threshold slope. **(5)**

Q(4): Derive the model equation for Schechman-Hodge MOSFET model (Level-0 model) and use the same to solve the following problem: **(10)**

"An N-channel MOSFET is operated with its source and body terminals grounded, and 1V applied to the gate terminal. Determine the drain current for applied drain potential=0.2V and 5V. Also, determine the bias to be applied to the body terminal which would make the drain current = 0. Given: - V_{TNO} = 0.7 V, K_N'= 40 μA/V^2, Υ = 0.4 V$^{0.5}$, $2\varphi_F$ = 0.6 V, W=10 μm, L=1μm".

Q(6) : What is base width modulation and high level injection in the light of pnp transistor. And hence derive the model equation that includes the base width modulation and high level injection. **(10)**

Best of luck