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Name: Roll No.:

104

National Institute of Technology, Hamirpur (HP)

Name of Examination: B. Tech.

(Nov-2023)

Branch : ECE
Course Name : Electronic Device Modeling

Semester : 5th
Course Code : EC-432

Time: 3 Hours

Maximum Marks: 50

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

- Q1. 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)
- Q2. (a) Determine the equation of diode current for a p⁺-n Junction diode. (5)
(b) Draw the energy band diagram of a n-MOS structure in accumulation, depletion and inversion mode of operation. (5)
- Q3. (a) Discuss the impact of substrate bias on threshold voltage of MOSFET. Explain its importance (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)
- Q4. (a) With the knowledge that $\mu_p \approx 0.4 \mu_n$, what must be relative width of n-channel and p-channel MOSFET devices if they are to have equal drain currents when operated in saturation mode with overdrive voltage of same magnitude? (5)
(b) An n-channel MOSFET device in a Technology for which oxide thickness is 20 μm , minimum gate length 1 μm , $k_n = 100 \mu\text{A}/\text{V}^2$ and $V_t = 0.8 \text{ V}$ operates in saturation region with small V_{DS} and with gate-source voltage in the range of 0 V to + 5 V. What device width is needed to ensure that minimum available resistance is 1 K Ω ? (5)
- Q5. Explain the Eber Moll's level-1, level-2, and level-3 model of BJT. Also mention limitations of each level. (10)