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Code No.: 6134 M

VASAVI COLLEGE OF ENGINEERING (Autonomous), HYDERABAD

M.E. (CBCS : ECE) I-Semester Make up Examinations, March-2017

(Embedded Systems & VLSI Design)

Physics of Semiconductor Devices

Time: 3 hours

Max. Marks: 70

Note: Answer ALL questions in Part-A and any FIVE from Part-B

Part-A (10 × 2 = 20 Marks)

1. What is the significance of "Miller indices", referred to semiconductor crystallography?
2. A sample of Si is doped with 10^{16} Phosphorus atoms/cm³. Find the Hall voltage in sample with $W = 500\mu\text{m}$, $A = 2.5 \times 10^{-3}$, $I = 1\text{mA}$, and $B_z = 10^{-4}$ Wb/cm².
3. Compare diffusion and depletion type capacitances.
4. List out the salient features of high frequency transistors.
5. How does trapped charges and oxide charges affect flat band voltage in MOSDIODE / MOSFET?
6. What are the applications of MIS diode?
7. Calculate the threshold voltage for an n-channel SOI device having $N_A = 10^{17}$ cm⁻³, $d = 5\text{nm}$ and $Q_f/q = 5 \times 10^{11}$ cm². Silicon thickness d_{Si} for the device is 50nm.
(Given: $C_0 = 6.9 \times 10^{-7}$ F/cm⁻³, $V_{\text{FB}} = -1.1\text{V}$ and $2\psi_B = 0.84\text{V}$).
8. What is drain induced barrier lowering in MOSFET?
9. Distinguish "direct tunneling" and "indirect tunneling".
10. Define Quantum Efficiency for an LED.

Part-B (5 × 10 = 50 Marks)

11. a) With a neat diagram, explain about the Gunn Effect. [5]
b) Discuss in detail about generation and recombination types in semiconductors. [5]
12. a) Explain in detail about Gummel poon model. [6]
b) Discuss about breakdown of transistor including secondary breakdown. [4]
13. a) Enumerate operational concepts involved in different types of MISFET. [6]
b) Compare JFET and MESFET. [4]
14. a) With the help of necessary diagrams, explain the short channel effect reduction techniques. [5]
b) A MOSFET has a threshold voltage of $V_T = 0.5\text{V}$, a sub threshold swing of 100 mV/decade, and a drain current of 0.1 μA at V_T . What is the sub threshold leakage current at $V_G = 0$? [5]
15. a) Explain the principle of operation and advantages of Gallium-Arsenide devices. [5]
b) What are non-volatile memory devices and explain 'read', 'write' operation of floating gate devices. [5]

- 16. a) Discuss about High Field phenomena. [5]
- b) How does Hetro junction Bipolar Transistor (HBT) works well for high speed and high frequency applications than normal BJT? [5]

- 17. Write short notes on any *two* of the following:
 - a) Sub-threshold region characteristics of MOSFET [5]
 - b) Thin-film Transistor [5]
 - c) MIOS devices. [5]

