

**APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY**  
**FIRST SEMESTER M.TECH DEGREE EXAMINATION**

**Electronics & Communication Engineering**  
**(VLSI and Embedded Systems)**

**04EC6501—VLSI TECHNOLOGY**

Max. Marks : 60

Duration: 3 Hours

**PART A**

*Answer All Questions*

*Each question carries 3 marks*

1. Indicate the method of wafer preparation from Silicon ingot.
2. Write a note on Direct & Indirect bandgap materials .
3. What is early voltage in a BJT .
4. Explain substrate bias effect.
5. Indicate method of calculating capacitance of MOSFET.
6. Draw the low frequency circuit model of MOSFET including body effect.
7. Briefly explain junction isolation.
8. Write a short note on scaling.

**PART B**

*Each question carries 6 marks*

9. a) Discuss about czochralsky technique of crystal growth. (4)
- b) An electron beam is accelerated using a voltage equal to 30kV. Calculate the de-Broglie wavelength of electrons. ( $h = 6.626 \times 10^{-34}$  Js,  $m=9.1 \times 10^{-31}$  kg). (2)

OR

10. Briefly explain Ion implantation technique.
  11. Prove that Fermi level is invariant in a quantum mechanical system at thermal & electrical equilibrium.
- OR
12. With neat sketches explain the process of carrier generation & recombination methods.
  13. a) Derive the characteristic equation of the BJT relating the collector current to the base current. (3)
  - b) Briefly explain schottky diodes. (3)

OR

14. Derive Diode equation for PN junction.

15. a) Derive the expression for drain current as a function of gate to source voltage in MOSFETs. (4)  
b) An NMOS transistor has  $\mu_n C_{ox} = 60 \mu A/V^2$ ,  $W/L = 40$ ,  $V_t = 1V$  and  $V_A = 15V$ . Find 'g<sub>m</sub>' and 'r<sub>o</sub>' when bias voltage  $V_{GS} = 1.5V$  ? (2)

OR

16. Discuss structure of MOSFET & its principle of operation.

17. With neat figures explain Complete all frequency model of MOSFET.

OR

18. Draw the circuit of MOSFET source follower & derive expression for its gain.

19. a) Explain velocity saturation. (3)  
b) With neat figures explain dielectric isolation. (3)

OR

20. Write a note on tunneling and discuss about different techniques to reduce tunnelling.