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**BIELE-007**

# B.Tech. – VIEP – ELECTRONICS AND COMMUNICATION ENGINEERING (BTECVI)

## Term-End Examination

00706

**June, 2016**

## BIELE-007 : NANO-ELECTRONICS

*Time : 3 hours* *Maximum Marks : 70*

***Note :*** *Attempt any **seven** questions. All questions carry equal marks. Use of scientific calculator is allowed. Missing data, if any, may be suitably assumed.*

**1.** (a) What are the challenges of nano scale MOSFETs in sub-100 nm dimensions ?

(b) What is a technology node ? How is it defined ?

(c) What is beyond CMOS ?

(d) What are the interconnect issues in VLSI circuits ? $4 \times 2\frac{1}{2} = 10$

2. (a) How does oxide layer thickness play an important role in MOSFET operation ? *3*

(b) What do you mean by non-uniform dopant concentration in MOSFET technology ? *3*

(c) What is lithography and what is its role in IC fabrication technology ? Explain with a suitable diagram. *4*

3. (a) Explain the operation principle of MOSFET using an energy-band diagram in all modes of operation. *5*

(b) Derive the expression for threshold voltage of MOSFETs. *5*

4. (a) What is technology scaling ? How do the dimensions of MOSFETs scale down under constant field scaling ? *3*

(b) What is oxide breakdown ? How does it happen ? *3*

(c) What is velocity saturation ? Explain with a suitable diagram. *4*

5. (a) Explain the Silicon-On-Insulator (SOI) technology. How is it different from bulk MOSFET technology ? 5

(b) Explain the operation principle of FinFET with its characteristics graph. 5

6. (a) What do you mean by quantum well, quantum wire and quantum dots ? Explain each with its operation principle. 5

(b) Explain the operation principle of a single electron device. Differentiate between charge quantization and energy quantization. 5

7. (a) What is the difference between Homojunction and Heterojunction based devices ? Explain with suitable examples. 5

(b) Explain the different types of heterojunction based devices with their energy band diagrams. 5

8. (a) What are the unit processes of Nano-electronics device fabrication ? Show the fabrication flow of basic NMOS device. 5

(b) What are the differences between Coulomb blockade and Coulomb staircase ? 5

9. (a) Explain the operation principle of a CNFET by using suitable characteristics graphs. What is its use in electronic circuits ? 5

(b) Which semiconductor materials are very useful for spin controlled device operation ? How is spin useful for the operation of SpinFETs ? 5

10. Write short notes on any ***two*** of the following : *2×5=10*

(a) Heterojunction FET (HFET)

(b) Silicon-On-Nothing

(c) Strained Silicon